ENGINEERING AND MINING JOURNAL

NOVEMBER, 1940

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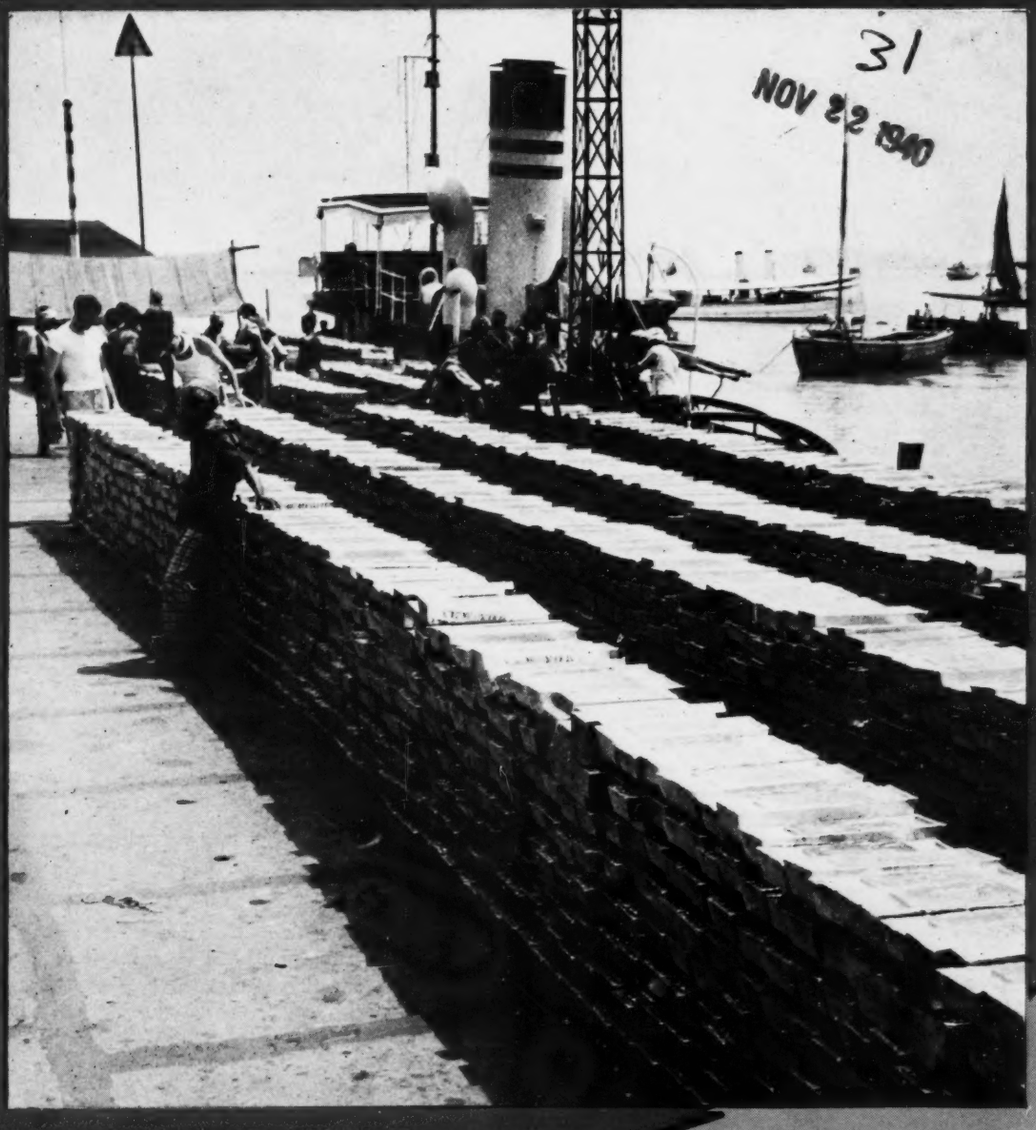

Pig tin on the dock at Georgetown, capital of Penang, Straits Settlements, awaiting shipment to New York

In this issue

Stresses in Mine Workings
Fundamentals of Mineral Property Valuation
More Facts on Mechanized Loading
Mine Haulage at Conda • Phosphate in Florida
Working a Geesse Gold Ore • Assaying Cyanide Solutions
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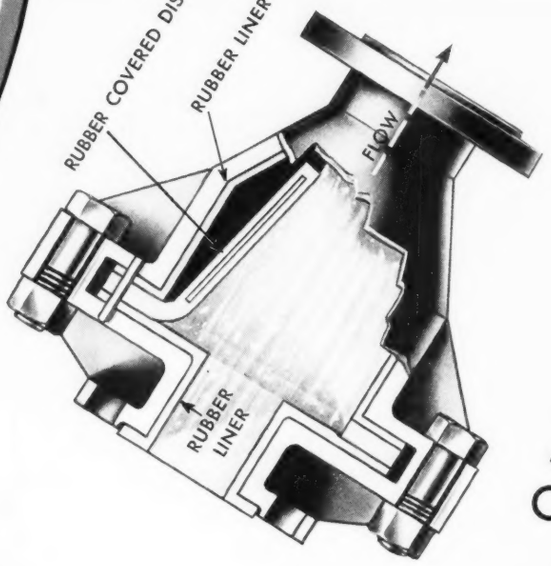
SELF HINGING FLEX-CHECK VALVE



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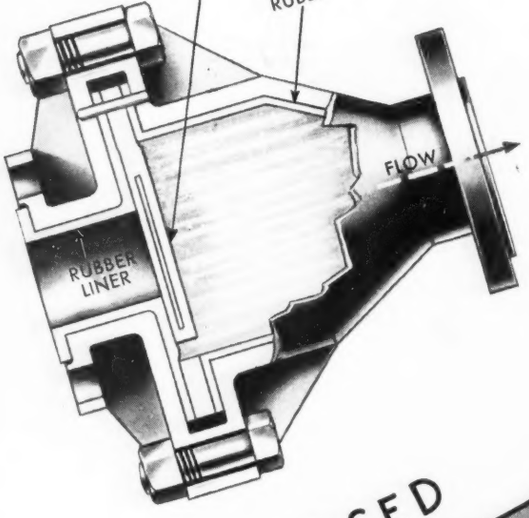

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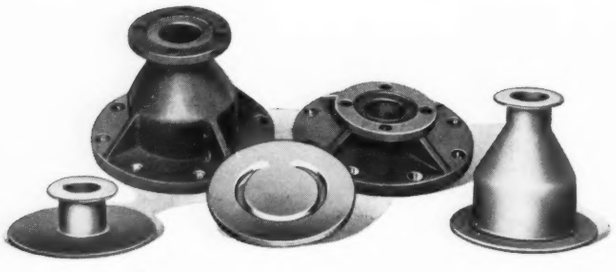

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Great Slave Lake, in Northwest Territories, Canada, is an area of growing interest to Canada, where gold prospects are being developed into producing mines. In the December issue John Murray McMeekan will describe the latest achievements in this district and mention some possibilities in the future exploration of an area north of Great Slave Lake at the termination of the war.

▼

Government crushing and cyanide plants are a feature of Australian mining. The Department of Mines reports that the five plants in South Australia have treated a total of approximately 68,538 tons of ore since they were started. The Mount Torrens plant treated approximately 423 tons in the second half of 1938, this from fourteen properties; the Petersborough plant 437 tons from 11; the Mongolata 154 tons from 8; the Tarcoola plant 490 tons from 15; and the Glenloth plant 549 tons from 8 properties.

▼

Celebes, island of the Dutch East Indies, rates as a new source of nickel ore, with initial production in 1938. Large shipments to Germany for test purposes were reported prior to last September. Société de Nickel, of the French Colony of New Caledonia, is seeking a concession for mining in this Dutch possession, a Consular office reports.

▼

Brazil is becoming more conscious of her mineral resources. The President of that country recently established, by decree, a National Mining and Metallurgical Council to consist of native-born Brazilians who are specialists in mining and metallurgy. The council will consist of seven engineers and will have its headquarters in Rio de Janeiro. Problems of the industry will be studied, such as costs of production, financial and economic phases of the industry and suggestion of rules and regulations for the mining industry.

H. C. PARMELEE
Editorial Director

ENGINEERING AND MINING JOURNAL

H. W. CLARKE
Vice-President

Published by McGraw-Hill Publishing Co., Inc.

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COVER ILLUSTRATION: Pig tin on the dock at Georgetown, capital of Penang, Straits Settlements, awaiting shipment to New York. Photo by Alfred T. Palmer

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Publication Office: 99-129 N. Broadway, Albany, N. Y.

Editorial and Executive Offices: 330 W. 42d Street, New York, N. Y. Cable Address: McGraw-Hill, New York

Branch Offices: San Francisco, 68 Post St.; Chicago, 520 N. Michigan Ave.; Washington, D. C., National Press Building

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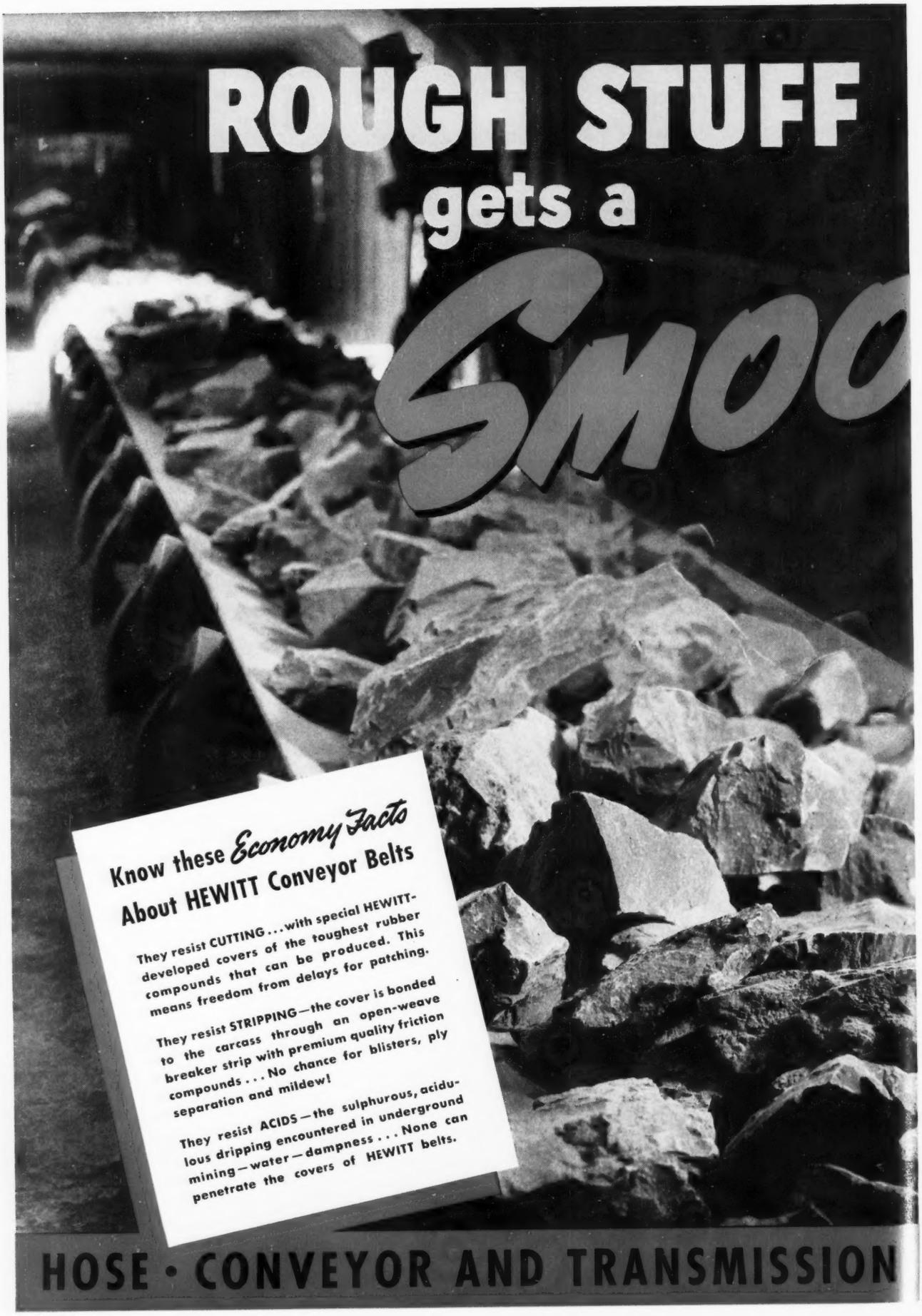
Aldwych House, Aldwych, London, W. C. 2, England — Cable Address: Backlash, Estrand, London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Volume 141 NOVEMBER, 1940 Number 11

War Demand for Metals

SPEAKING A YEAR AGO on the rôle of minerals in war, Dr. C. K. Leith expressed the opinion that control of world mineral resources by the Allies would result in the ultimate defeat of Germany through "sheer weight of metal." Last September, at the meeting of the American Mining Congress, he amended his earlier remarks by predicating military success, not on the mere *possession* of mineral resources, but on their active *use* in war matériel. The distinction is obvious, and one that doubtless was assumed in the first instance. The Allies had lagged in production and use of munitions, in marked contrast to the feverish activity of Germany, which used its mineral resources to the limit. Hence the apparent anomaly in Dr. Leith's contention.

The thought suggests an inquiry into our own use of the extensive mineral resources with which the United States is blessed. Earlier in the year we commented on the fact that the war was making little demand on our potential production; but last month we observed that the full effect of war on the domestic mining industry was beginning to be felt. Now the impact is fully evident as the United States engages simultaneously in production of munitions for Britain and for our own program of national defense.

Observe the gains in United States production of the major non-ferrous metals in the first nine months of this year compared with the same period of 1939:

	January-September 1939	1940	Per Cent Gain
Copper, duty free, refined, tons ...	573,024	757,316	32.2
Lead, refined, domestic account, tons	361,346	409,048	13.2
Zinc, domestic account, tons	376,616	467,248	24.1
Quicksilver, domestic, flasks of 76 lb.	13,636	25,600	87.7

Other indications of metal use in the United States are found in domestic steel operations, which are running virtually at capacity. Shipments of iron ore from Upper Lake Ports through October are placed officially at 58,296,358 gross tons, a gain of 47.2 per cent over the shipments of 1939. In October alone these shipments amounted to the huge total of 10,061,127 gross tons, indicating that the 1940 season may establish a record.

All of which suggests an observation that can be made with considerable satisfaction. The United States not only possesses extensive mineral resources, but is producing and converting metals into war matériel at a high rate of activity. If sheer weight of metal is to turn the tide, the flow from this country has now begun.

Equipment Exports to Canada

WITH THE ENTRY of Canada into the war, the Dominion Government was confronted with inevitable financial problems, among others the conservation of foreign exchange. By June 25, 1940, when the Minister of Finance delivered his budget address to the Parliament, foreign exchange had assumed such importance that the Minister urged everyone to restrict imports wherever practical to do so. For the Canadian mining industry this meant to stop buying mining and milling equipment in the United States, which had hitherto been the principal source of supply.

The immediate effect of the budget speech in the United States was a sharp drop in sales of mining equipment to Canada. It was not long, however, before the policy advocated by the Canadian Minister was found to be a two-edged weapon, one edge of which threatened to cut sharply at Dominion metal production. Delays in delivering equipment ordered from Canadian

manufacturers were holding up the completion and operation of mills, all of which meant the deferred production of gold and other metals.

Practical counsel then began to advocate a change in Canadian policy, the argument running about like this: Canadian machinery manufacturers are preoccupied with war orders and cannot give customary service to the domestic mining industry. This hampers the production of gold and other metals vital to the prosecution of the war. The United States offers the sole market for Canadian gold, with its creation of foreign exchange, so why not produce to the limit even if it is necessary to buy mining equipment in the United States.

This is sound argument for a country that will probably produce in 1940 more than $200,000,000 in gold—a war munition if ever there was one. Probably the best rôle the United States can play in the war is to buy gold from Britain and her allies and use our manufacturing facilities to supplement those of countries at war. Disparity in currencies will prove to be of minor importance compared with the advantage of consolidating the resources of the Western Hemisphere and keeping the united industrial machine functioning smoothly and producing at a high rate.

Metallurgy for Suckers

SOME METALLURGICAL PROCESSES, particularly those that recover from worthless rock "more gold than the fire assay shows," are designed primarily to extract dollars from the pockets of suckers. Despite repeated exposure, these fake processes and their charlatan operators survive because the crop of suckers is perennial and cupidity is still a trait of human character.

The latest flower to bloom in the garden of metallurgical hokum is exhibited to the public in the columns of the Los Angeles *Times* for October 28, 1940. There we learn of the marvels of colloidal chemistry, particularly in the hands of one Dr. Christian Paul. From ordinary sand and water—oh yes, and a little quicksilver—the good doctor produces gold. The idea is to grind the sand so fine that the valuable metals and minerals virtually combine with the water. Finally, the water becomes so saturated with gold in a colloidal state that it dumps its load and goes back for more. And similar nonsense *ad nauseam*.

The Los Angeles *Times* does a distinct disservice to itself, its city, and its State, by publishing such twaddle as it attributes to Dr. Christian Paul. Nor can it plead isolation from sources of information where it might check Dr. Paul's visionary claims. Is not the California Institute of Technology at hand, with its scientists and engineers of world-wide repute? Or, if that is too far away, we remind the *Times* that John Herman, local assayer and chemist, has long offered to post $1,000 to be forfeited to Dr. Paul, or to any other promoter of freak processes, who demonstrates to the satisfaction of competent authorities the recovery of gold not shown by the fire assay.

The *Times* ought to know better—probably does. And it ought to safeguard more zealously the reputation of its fair city by exposing rather than publicizing the achievements of fake promoters.

N L R B — A National Disgrace

IF YOU CAN RISK THE DANGER of high blood pressure we suggest that you read a public document officially described as House Report No. 1902, 76th Congress, 3d Session. It is an intermediate report of the special committee of the House of Representatives appointed to investigate the National Labor Relations Board. Your Congressman can obtain a copy for you. We warn you, however, that your indignation is likely to rise to a dangerous pitch and your blood boil as you read one sordid revelation after another.

It didn't require a Congressional investigation to create the popular impression that the National Labor Relations Board was probably the most arrogant and presumptuous of all the Federal agencies. But the inquiry did reveal a scornful contempt of the rights of employers and an insolent disregard of public policy that more than confirmed earlier popular opinion.

Among the nefarious administrative practices of Board members were blacklisting, boycott promotion, lobbying, and the solicitation of litigation. Incompetence, bias, and partiality were found among the Board's employees—in the Secretary's office, among special and trial examiners, in the division of economic research, and in the review division of more than one hundred attorneys. The Board itself was guilty of practices that went far beyond the language, scope, and intent of the law. It invented "remedies" not provided for by the act, such as the "reinstatement" of men never employed, reinstatement of employees guilty of violence, the ordering of back pay where there was no allegation of discriminatory discharge, and the holding of "run-off" elections. On the whole, a story of maladministration which can be remedied only by amendment of the Labor Act and the reconstitution of the Board and staff so that *all* are men of integrity and impartiality.

Stresses in Mine Workings

An engineering procedure for their determination and control is found in barodynamics, aided by photoelastics

Philip B. Bucky
Associate Professor of Mining
Columbia University
New York

THE MINE EXECUTIVE appreciates readily the effects of such things as taxes, wages, and mechanization on his costs and profits and, in the case of mechanization, on the safety of operation also. In this article, however, a factor is brought to his attention, which usually will have a greater effect on the cost and safety item than any of those mentioned. It has not been well understood in the past, and is not fully comprehended at present. Here it is referred to as "stress."

The term "stress" as used here refers to physical stress and is spoken of as so many pounds per square inch, in tension, compression, or shear. It is generally due to a load or weight of some kind acting on mine props, pillars, roofs, or bottoms, and results in the breaking of props and roofs, the heaving of bottoms, the increase in the accident rate, the failure of pillars, the rock bursts which so many of our deep mines must contend with, and the high maintenance costs which are ordinarily present in at least one section of every mine. The reader probably realizes that a procedure which makes it possible to determine what the stresses are in all portions of a mine, and the ability of the structural material there to stand up under them, cannot help but result in safer and more economical mining. Thus it will also aid in the conservation of our natural resources.

When a body—that is, a mine structure or a portion of it—is not stressed, it will not fail and will not require support to keep it in position, and it can therefore do no damage to any person or piece of equipment near it. The importance of stress, and its effects on costs and safety may readily be determined by comparing records in sections where evidence of high stress is present with those which exhibit them in a lesser degree. Stress is present in all workings, openings, and solid portions, and *management will, in general, find that an ability to understand stress and the methods of handling it will pay as great dividends as the ability to handle labor or machines or both.* As a matter of fact, the efficient and safe handling of labor and machines depends to a great extent on the efficient handling of the stresses involved in the mine.

An effort will therefore be made to explain in a not too detailed manner a method which makes it possible to determine what the stresses are and how they act at all points in a mining structure, to point out the limitations of the method, indicate places where it may be applied, and furnish the reader with references should he wish to acquaint himself personally with the detail and theory.

The mining engineer has had training in mechanics and the strength of materials. He has learned, and can probably recall, that materials stressed within the elastic limits[1] will stand for long periods of time; that steel, concrete, and wood have certain strengths (in pounds per square inch) in tension, compression, and shear. That while steel has elastic limits of strength, wood and concrete do not. That the elastic theory as he learned it does not apply perfectly to wood or concrete, but the use of a safety factor and a knowledge of the properties of these materials allows its use to design safe structures of these materials to stand for long periods of time.

His knowledge of geologic materials is primarily concerned with mineral content, chemical characteristics, crystal structure, hardness, and age as determined by fossils or sequence. Little time has been spent determining the strengths of these materials—that is, the physical properties which determine their behavior when part of a mine structure—and yet on these properties depend his life, the safety of his workmen, his ability to mechanize, and the efficiency of extraction.

Other engineers dealing with a few well-controlled materials of construction (steel, concrete, wood) have built significant data concerning the struc-

Fig. 1A . . . A diagrammatic sketch showing a centrifuge and photoelastic equipment (Fig. 1B) combined for making barodynamic tests on mine models

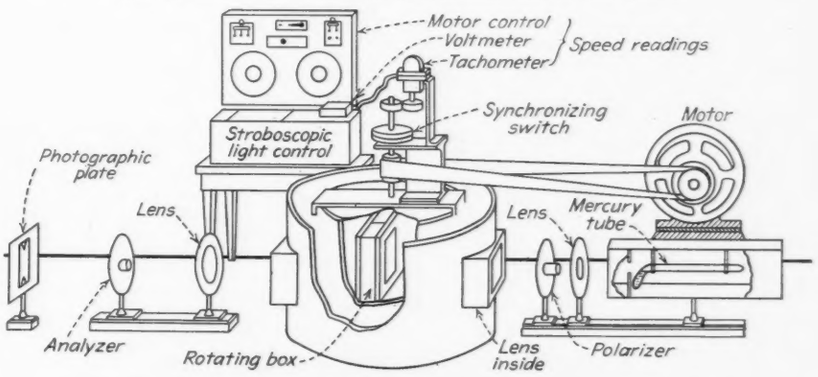
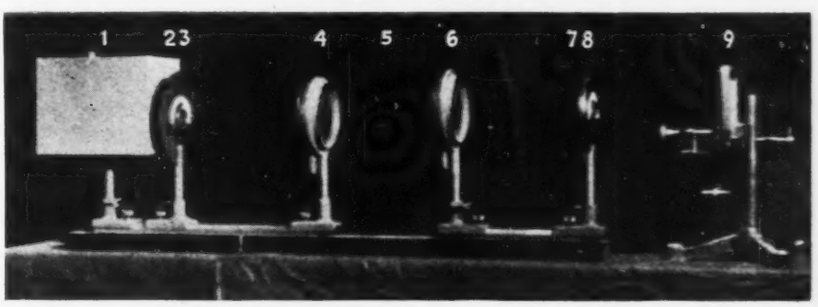


Fig. 1B . . . Photoelastic apparatus for determining the principal stresses, called P and Q, in a model of transparent material, and their directions: 1, Source. 2, Polarizer. 3, Quarter-wave plate. 4, Lens. 5, Space for model. 6, Lens. 7, Quarter-wave plate. 8, Analyzer. 9, Screen



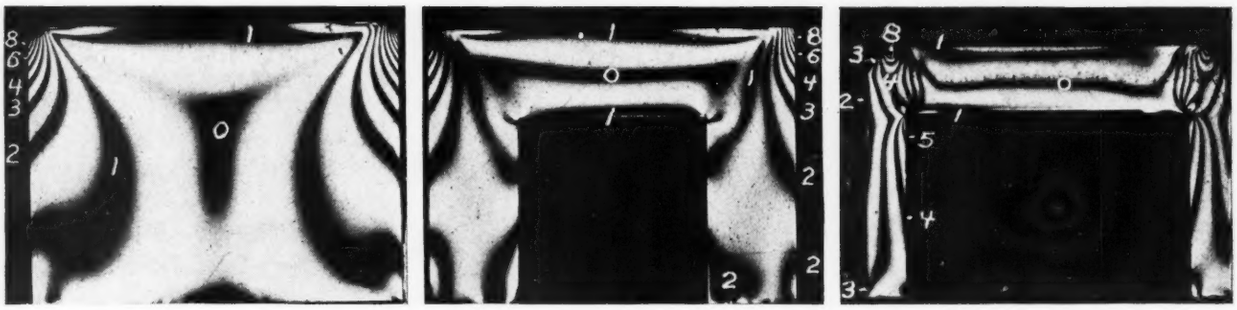


Fig. 2 (A, B, and C) . . . Shear stresses in mined and solid pillars as observed in transparent mine models with the aid of combined centrifugal and photoelastic equipment. Each numbered dark area is a fringe or contour area of shear stress. See text

tural properties of these materials. The literature on these subjects is vast and the results of this knowledge are evident to the eye in the large structures in all localities. Though it is true that their problems deal only with structures stressed within the elastic limits, it is also true that a great many mining structures or parts thereof should be so designed.

If one substitutes for the phrase "structures designed within the elastic limits," another phrase "structures designed to stand for long periods of time," it may be realized that many mining problems come within this category. In all mines some parts must have a comparatively long life; for example, shafts and shaft pillars. Others may have a shorter life, such as gangways and levels; and still others may have a comparatively short life, as stopes, breasts, and rooms. The surface in some cases need be given little consideration, except for the surface plant, whereas in others where the workings underlie cities, as at Scranton, Wilkes-Barre, and Hazelton, in the anthracite fields; Butte, in the copper region; certain portions of the bituminous fields in Illinois, and others too numerous to mention, the problem becomes an important one with respect to recoverable ore or coal, property damage, and procedures in mining.

In all steeply dipping deposits the correct placing of gangways or haulage drifts with reference to stopes or breasts has an enormous effect on both maintenance costs and safety. The same may also be said for the placing of chutes and transfer levels in massive deposits mined by caving or slicing methods. It thus becomes apparent that in determining the procedure for mining an orebody the important things to determine are: (1) which portions may be designed to fail immediately; (2) which shall fail after a given period of time; and (3) which portions must be designed to stand for long periods of time. Though the general method decribed in the preceding article[1] may be applied to the solution of all these problems, the method of stress analyses to be described, known as the photoelastic method, is applicable only to structures stressed

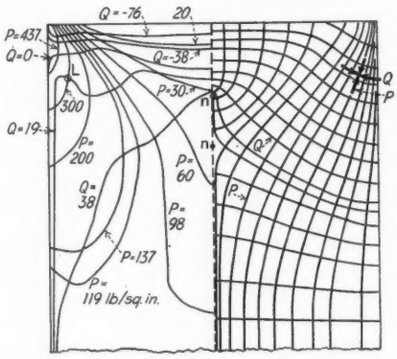


Fig. 3 . . . This diagram, constructed from a series of pictures taken of solid pillar (Fig. 2A) shows the value of the principal stresses, P and Q, and their directions at all points in the pillar. Left, stress contours. Right, directions

within the elastic limits (those designed to stand for long periods of time). It may be explained as follows:

Inasmuch as the theory of elasticity informs us that all materials stressed within their own elastic limits[2] behave the same, a given load on glass, bakelite, concrete, steel, or sandstone beams of the same dimensions will cause the same stresses and stress distributions in all of them. However, a transparent glass, celluloid or bakelite beam when stressed and placed between certain apparatus, Fig. 1A and 1B, through which polarized light (light vibrating in one direction) is passed, causes pictures of a certain sort to be seen, depending upon the magnitude of the stresses, their distribution, and their direction of action. Therefore a model of transparent material such as glass, bakelite, or celluloid may be used to determine what the stress and direction of action is at all points in structures of non-transparent materials such as concrete, wood, steel, or sandstone, provided they are not stressed beyond the elastic limits and these pictures are interpreted correctly. For most mining work, models should be loaded as they are in the field—that is, by means of a centrifuge[1] The combined centrifugal and photoelastic equipment is shown in Fig. 1A.

It is not believed that a complete description of the apparatus, the function of the various parts, the development of the theory, or the procedure involved need be discussed here. The information is available in A.I.M.E. publication T.P. 1140, entitled "Photoelasticity and Its Application to Mine Pillar and Tunnel Problems," which also gives a rather complete bibliography.

To illustrate the working of this method, an example of the visible stress effects obtained when placing a bakelite pillar loaded in a given manner in the photoelastic apparatus is shown in Fig. 2(A-C). Each numbered dark area is a fringe or contour area of shear stress. The value of each fringe shown in Table I is determined as 78 lb. per square inch more or less than the preceding one by experiment. It therefore informs one (Fig. 2A) that over most of the pillar the stress is 1×78, or 78 lb. per square inch, and at the upper corners the stress is 8×78, or 624 lb. per square inch. If the material in the mine will stand a stress of 3,120 lb. per square inch, the pillar will not fail in any part, as the safety factor is $3{,}120\div624$, or 5.

Fig. 3 is constructed from a series of pictures which were taken of the solid pillar, Fig. 2A, and shows the value of the principal stresses called P and Q and their direction at all points in the pillar. For example, at point L on the left, the P stress is 300 lb. per square inch and the Q stress 19 lb. per square inch, acting in the direction of the heavy arrows, at the corresponding point shown on the right.

It is therefore evident that a means is available for determining the stresses at all points in a pillar, which may be represented by a photoelastic model. If the strength of the material is known, conclusions may be reached as to whether the pillar will stand or fail, at what parts failure will start, whether different shapes will provide better support and what portions of it may be mined.

[1] See "A Practical Way of Attacking Problems of Structure and Ground Support," by Philip B. Bucky, *E.&M.J.*, July, 1940.

[2] Elastic limit: A maximum unit stress to which a bar of the given material may be put, and on the release of which the bar assumes its original dimensions at zero stress.

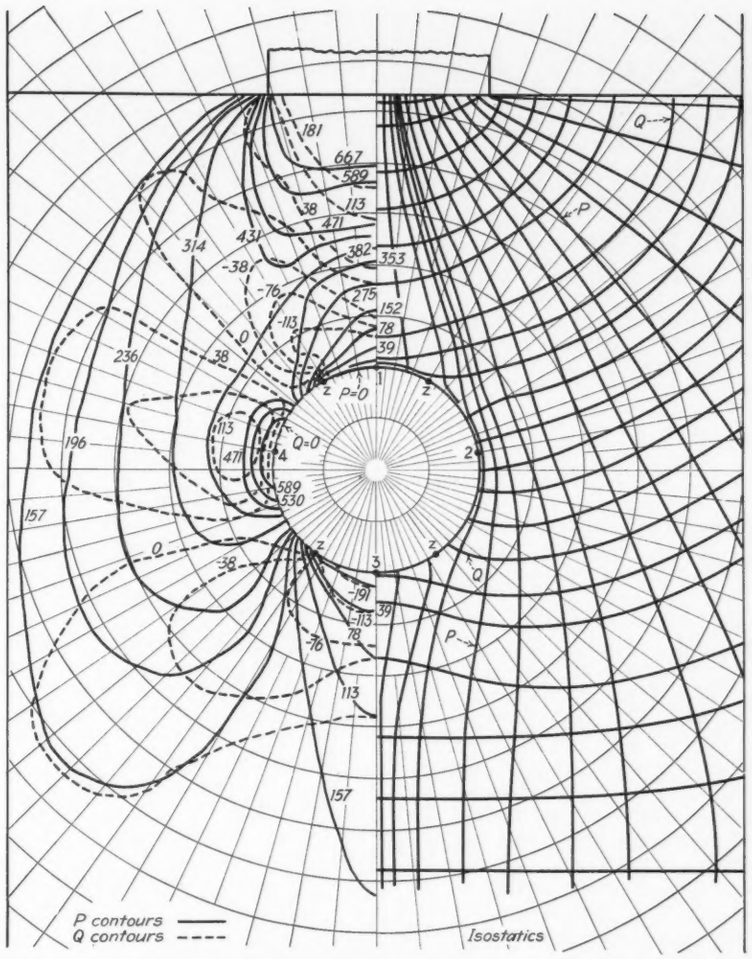
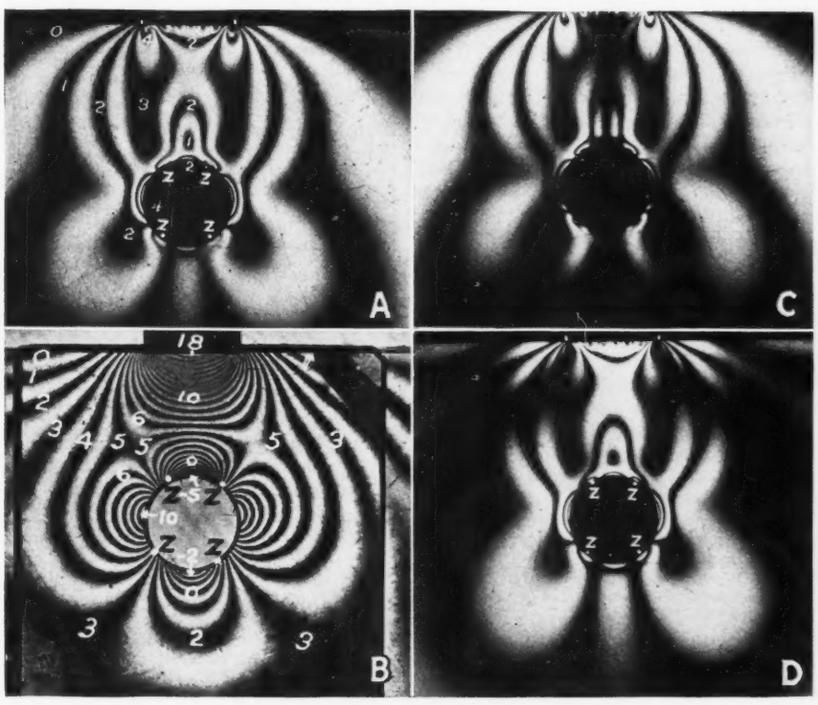


Fig. 5 . . . This diagram was made from pictures taken of the tunnel model referred to in Fig. 4. It shows the principal stress values and directions at all points

Fig. 4 (A, B, C, and D) . . . Visible stress effects that occur in strata around tunnel driven in stope floor directly below pillar, as observed in a transparent bakelite model tested. The black rectangle directly above "18" represents the pillar. See also Fig. 6



It may or may not surprise the reader to learn that large portions of certain pillars may be mined, that the load may not be taken by the whole pillar, but by portions of it, and that certain shapes are better able to carry load than others. This is illustrated in Figs. 2B and C, from which it may be noted that even with 60 per cent of the pillar mined out, the maximum stress is still 624 lb. per square inch, at the corners as before, though the maximum stress in the legs is only 312 lb. per square inch. If the material has a strength of 3,120 lb. per square inch, this pillar with 60 per cent of it mined is just as capable of supporting the load as a solid one. Pillar dimensions and shape to support the surface may thus be determined by these methods and the amounts of material that may be removed from old workings reasonably estimated.

At present, the evidence of load and stress underground are the breaking of timbers, pillars, roof or bottom heave, pillar spalling, and roof sag. A gangway (a drift with chutes) recently visited showed all of these with maintenance costs at least $50 per foot per year. Important considerations, therefore, are the disposition of haulageways and openings relative to pillars, and worked out and working areas. Will these openings stand? Will they require large maintenance costs? Can these openings be placed so that maintenance costs will be low and safety at a maximum? These are questions which vitally concern all operations working steeply inclined deposits by any method, and massive deposits by caving or slicing methods.

That this field has scarcely been scratched is probably realized, and that this method may prove of value is illustrated by the following:

Fig. 4 (A—D) shows the visible effects that occur in a bakelite model of a tunnel and the intervening strata between it and the pillar directly above it and the stope floor. Fig. 5 shows the principal stress values and directions at all points, and Table II shows the stress values at four important points in the tunnel. It is interesting to note from Fig. 5 that at the four points in the tunnel marked *Z* the stress is 0 and from Table II and Fig. 5 that at points 2 and 4 there is a compressive stress (shown by +) and that at points 1 and 3 there is a tensile stress (shown by —). The effects caused by placing the tunnel to one side of the pillar are quite marked as shown in Fig. 6. Both are more thoroughly discussed in T.P. 1140, but the marked reduction in tunnel stresses may easily be noted.

It thus becomes evident that barodynamic methods include the use of two types of models studied in centrifugal fields:

1. Models of the same material as the prototype to determine how a structure will behave through to fail-

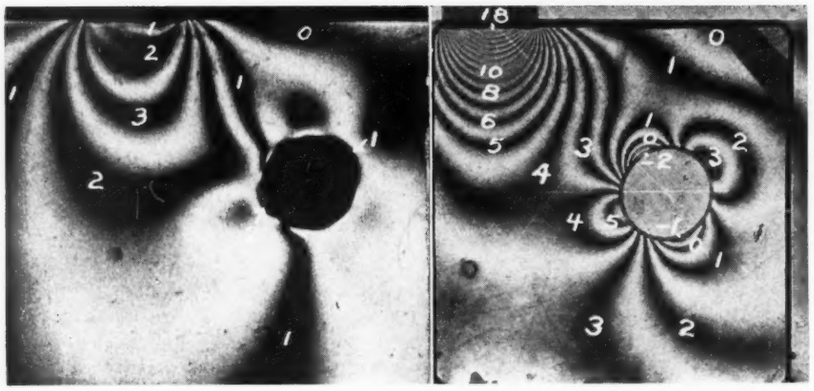


Fig. 6 . . . Visible stress effects as observed, in test model, around tunnel when this opening is placed to one side of the pillar

ure, and the time effects. This includes problems relating to block caving, stope- or room-and-pillar methods where support of the surface is not particularly essential, and problems concerned with heaving bottom and plastic materials.

2. Models of photoelastic materials as glass, bakelite, or celluloid to determine pillar shapes, spans, level and drift or gangway locations, in cases where openings are to stand for a considerable length of time, or the surface is to be permanently supported.

The development of the principles and procedures set forth in the foregoing enlarges considerably the field of the mining engineer. It makes laboratory studies and tests as important an adjunct to a mine as to a mill or metallurgical plant, and brings home the fact that there are innumerable possibilities in the mining game for a reduction of costs and an increase in safety.

At present the time lapse between pure and applied science—that is, engineering—is being shortened, and a greater appreciation of the value and importance of pure science is now making itself felt.

When Michael Faraday discovered the principles of electromagnetic induction, which he embodied in an experiment that was demonstrated before the King, he was met with the remark, "Of what practical use is it?" To which he replied that it was of tremendous value to the Crown, for some day it would be taxed. How true this statement was is self-evident today; but how many of us can visualize the future effects of important discoveries being made today, or even know what they are? And how many have the background, vision, and courage to supply the additional technical and financial resources to bring these discoveries to profitable use within a ten- or fifteen-year period? Faraday's experiments gave us our present electrical age. Light, heat, and power, and all the wonders which flow from the electric dynamos and motors, employing directly the principles of Faraday's discoveries, relieve the hand toil we knew in the mines, and made our present mechanization inevitable.

Our understanding of the behavior of geologic structures or mines is definitely tied up with Newton's law of gravitation and principles of mechanics and similitude which he arrived at on the basis of the observation of the motion of the moon. It may seem far fetched to the mining man of today to correlate moon motion with mine-roof behavior and block caving, but these principles are not only the basis for that but also for all the complex mechanical things we possess today, including the loading machine.

The relationship between apparently useless discoveries and future importance may probably best be illustrated as follows: Within the last century Goodyear learned to vulcanize rubber. The connection with flying comes as follows: Latex to rubber, rubber to the perfected pneumatic tire, the pneumatic tire to the perfected automobile, and its powerful light internal combustion engine, which in conjunction with the Wright brothers' application of the principles of mechanics discovered by Newton made possible an airplane that could really fly and carry loads. It is apparently a far cry from Newton and Goodyear to the present airplane, but these two men gave us the ability to lift ourselves into the air. They gave us rubber-tired mine haulage as well.

When, in 1678 approximately, Hooke gave us Hooke's law, Young his modulus, and Poisson his ratio, all relating to the behavior of materials stressed within the elastic limits, they, with Newton, gave us the basis for present knowledge of the strength of materials. When Brewster, in 1816, discovered the phenomena of double fraction in certain materials, that, plus the previous knowledge, gave us the basis for our present photoelastics, a procedure whereby pictures are obtained showing what the stresses are at all points in a structure and how they act.

It is hard to realize that a phenomenal growth in photoelastics has taken place since 1920—that is, within the last twenty years—due to a realization that stress knowledge is a very important item in the design of all structural or machine parts that are under load, and that these procedures give stress information previously unattainable. One need visit only a few properties, and check those portions where maintenance costs are high, to see the applicability and possibilities in photoelastics.

Table I—Fringe Values

Fringe No.	Value in Lb. Per Sq. In.
1	78
2	156
3	234
4	312
5	390
6	468
7	546
8	624
. . .	. . .
10	780

Table II—Observed and Calculated Tunnel Boundary Stresses at Points 1, 2, 3, 4, Fig. 5

Point	ψ	θ	Lb. per Sq. In. Average Observed S_1	Lb. per Sq. In. Calculated S_1
1	90°	42°	—307 (*a*)	—283 (*a*)
2, 4	0°, 180°	30°	728 (*b*)	712 (*b*)
3	—90°	25°	—224	—192 (*a*)

(*a*) tension. (*b*) compression.

Mount Diablo Cinnabar Deposits

THE Mount Diablo district, 30 miles northeast of San Francisco, is one of the few Californian quicksilver districts that have recently come into prominence, according to United States Geological Survey Bulletin 922-B. It was productive from 1936 through 1939, and its single operating property has been among the leaders of the industry. The lodes are in fracture zones near the footwalls of inclined, more or less tabular serpentine masses in Franciscan rocks. They are thought to have been formed by hot-spring action so recent that it is still giving rise to sulphurous gases and methane. The lodes are unique in that metacinnabar is an abundant primary ore mineral. The oreshoots are in zones of intense brecciation and controlled in part by cross fractures.

When this district was visited in August, 1939, work had been temporarily suspended because of labor difficulties; but from September, 1939, at least through January, 1940, the production increased.

The Fundamentals Of Mineral Property Valuation

Adherence to conservative valuation formulas is suggested as the soundest course

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CONSIDERABLE discussion at the Petroleum and Mineral Economics sessions of the A. I. M. E. annual meeting in New York, last February, turned about the possible adoption of a common valuation formula for petroleum and mineral properties, in which for simplicity's sake a single rate of interest could be used, as in the present petroleum practice. It was urged that a rate somewhere between the low rate for compounding and the high or hazard rate of mine valuation by the Hoskold method be considered. There is much to recommend this single-rate procedure, inasmuch as all mineral resource valuations are at best a complex compromise involving certain factors that defy precise measurement, the proper employment of which rests to large extent on the skill and experience of the engineer. A striking contention in the comment arising on the mining side indicated a strong disposition to retain the double-rate procedure in that industry, the view being that the existence and display of the low amortization rates employed in Hoskold-Morkill procedures are conducive to the serenity of judge and jury when mineral property valuations are under fire in the courts of the land.

It is a curious fact that mining shares as expressed in stock-market quotations on the various exchanges commonly show over-valuation by the public—tremendously so, at certain times, less so at others—as, for example, the great mines of the South African Rand in their early days, and various major American and Canadian properties. Writings and commentaries on mining economics in the technical and financial journals frequently score this peculiar trend, in the light of this Hoskold amortization analysis, but the investing public, in popular stock-market appraisal, persists to surprising degree in this precarious habit.

We shall assume that we have just returned from six months in the field, where we have had at our disposal adequate facilities for examination and sampling, and that we have, therefore, an assay map and all essential measurements of the mineral property. We have been enabled to arrive in due and ancient form at tonnage appraisal of the reserve, capacity of the mining and milling equipment to be installed, and the approximate life of the property; we have determined operating costs and future price trend to a point of reasonably outlining net earnings in total. What is the property worth? Seller has a case; buyer has a case. Our task is to bring these divergent ideas, usually far apart and strongly held, to a price basis on which business can be transacted.

When all is said and done, it seems to me that the mining business, in intrinsic character, compels the contention that the buyer is the one whose interest and risks in such matters the engineering profession must measure and meet. In far the majority of cases the nature of mining is such that the buyer who seeks a high rate of interest on his invested capital—a rate in fact considerably higher than prevalent on less problematical industries in which the physical assets and reserves will stay on the job—is to be regarded as a reasonable and sane citizen and to be assisted toward his objective. Without taking sides, it seems a safe generalization that a reasonably satisfied buyer should, in the long run, mean a satisfied seller, a satisfied Tax Commission, a satisfied mortgagee.

The intelligent buyer of a mineral deposit will measure his requirements as follows: (1) The recovery of the purchase price plus all the money (with interest) he spends on prospecting, developing, equipping, and in addition (2) A substantial profit. The degree or amount of profit is properly a direct function of the estimated risk. This rate, known as the "hazard" "speculative" or "risk" rate, is calculated usually between the limits of 5 and 20 per cent. Seldom below 8, it in some cases may have exceeded 20 as a justified return in mining investment.

Fundamentals—The backbone of mine valuation is the *present worth* of an annual dividend that may be soundly estimated as accruing during the period of the mine's life. This term "present worth" (present value) means the *value today* of the total future earnings of an enterprise. It is this figure of present value or worth that is at the heart of conservatively adequate mine appraisal and valuation.

The ultimate value of a mineral deposit is measured, of course, by the total profit that can be obtained by the extraction and sale of the ore over and above the return of the capital invested in the property. This actual total value can be obtained and determined only after the mine has been completely worked out and abandoned. To approximate this final figure, and to do so at the time of purchase or at any moment during the operating life, future profits must be translated and discounted into their actual value at the time the calculation is made. Predetermined rates of interest must be used, and as a mine is a wasting asset each dividend must be regarded as representing not only interest on the money put into the mine, but also a partial return of the invested capital. By the time the deposit is exhausted the investor should have had returned to him the money he contributed to the venture together with the proper amount of interest on that money for the time it has been in use.

Hoskold Formula—H. P. Hoskold, in 1877, worked out a formula by which the present value or present worth can be calculated, and this formula continues in wide use by mining engineers, with modifications and adaptations for local conditions. The present worth or value of a mining property may be defined—and the definition is admittedly an involved one—as a sum of money on which there could be paid from operating profits (that is, total net dividends) two things: first, a determined rate of speculative or risk interest and, second, an amount which, if invested at moderate compound interest as received, would at the end of the life of the mine pay back the present value. The theory on which the Hoskold formula is based, is, to repeat, that

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An article on "A Valuation of Oil and Natural Gas Properties as Distinguished from Mines," by Lyon F. Terry, of the Chase National Bank, was printed in the Institute's publication *Mining and Metallurgy* last May. My article, presented in the following paragraphs, treats the subject from the mining engineering viewpoint.

the dividend received from a mining investment must be regarded by the investor as being composed of two distinct parts, one representing interest on the original investment (at a rate considered commensurate with the risk) and the other a return of capital, which latter portion must be of such amount that, when reinvested at compound interest (security or safe rate), it will equal the amount of the original investment when the mine is exhausted and the dividends cease.

With $1 as the unit of dividend, the Hoskold formula for the calculation of present value takes the form (in Baxter-Parks symbols[1])

$$V_p = \frac{A}{\frac{r}{(1+r)^n - 1} + r'}$$

in which

A is annuity or annual dividend
V_p is present value of annuity A
r is interest rate on capital redemption fund (security or safe rate)
r' is speculative rate to purchaser on his capital investment
n is years life.

By the use of amortization tables and nomographs the present value of $1 of dividend accumulating during n years is readily calculated. This present value of $1 may be multiplied by the total average yearly dividend to give the present value of the mine. This resultant figure is the sum of money that may justifiably be allowed for purchase of the mine and expense of development and equipment, if the investor be satisfied with the return of his capital in n years, r' per cent on his mining investment, and the possibility of further profits if ore is later developed in excess of the estimated amount.

It is seen that present worth thus calculated rests essentially on an estimated figure of future annual earnings, a figure which is, of course, susceptible of more than one interpretation, the interpretation depending on the engineer who has examined and sampled the mine and on the data he has collected. The mathematical solution of the formula is more or less a simple matter, but the all-around propriety of the resultant valuation figure is dependent on the foundation built under the formula, the blocks in this foundation being principally the reserve tonnage and rate of mining, the cost and profit per ton of operations, and the interest rates assumed.

The selection of the higher, risk or hazard rate of interest that is to be applied as the buyer's profit incentive is of paramount importance and it should rest on the measure of accuracy with which the reserve and earnings estimates can be viewed. To warrant a low rate it is necessary not only that a formidable array of physical data be judged with a high degree of accuracy: (geology, tonnage reserve, sampling, and operating costs both direct and indirect), but that the future outlook in world-wide financial and political quarters be examined with careful perspective. Future price trends and the earning power of investment funds must be sanely predicted. Bonds and preferred securities that now carry 3 to 3½ per cent were, a decade or two ago, considered standard at 6 to 7 per cent. On the other hand, interest rates that at the moment are more or less acceptable for the short term may be regarded as inadequate by an investor contemplating future production under the double hazard of shifting economics and the uncertainties of metal deposits in general.

In the selection of the interest rate to be used for the accumulation of the sinking fund by which the purchase price is amortized, it is customary to take a rate currently returned on bonds of the best grade or on savings-bank accounts. (The reader is permitted a nostalgic quiver as he recalls the common assumption, not many years ago, of 4 per cent.)

Mineral valuations one and all are dependent on the following four features:

1. Profits that can be realized from the known ore.

2. Prospective profits that can be realized from extensions of the ore beyond exposures.

3. Effect of a higher or lower price for the metal or mineral (gold now included).

4. Efficiency of management during realization.

The first of these may be regarded as the positive value in the case and can be closely determined by sampling and test treatments. The second and third may be termed the speculative values and are largely a matter of judgment, geology, and industrial interpretation. The fourth is a question of development, equipment, and engineering method, together with capable executive control.

Prospects—As defined in mining perspective, prospects are newly discovered properties, or reopened old mines, where little or no positive ore, (four-sided, in blocks of reasonable size, and in certain cases, three-sided ore) exist. A prospect usually has no tonnage on which an estimate of assured profits can be based and the first of the four features cited can play little part in the valuation. The problem of the prospect must obviously rest on the speculative divisions 2, 3, and 4. Experience and personal attitude of the examining engineer on one hand, and the owner on the other, now assume large importance. Extreme attitudes are undesirable—neither optimism or pessimism should be capitalized, else the result will be inaction on a deposit possibly worth while. The range is zero to bonanza, and it is exceedingly difficult for any two men to form the same estimate of a prospect. Reduction of pertinent conditions into reasonable bearing on the Hoskold formula tends to hold prospect appraisal in line.

Sidelights on Valuations—It is to be noted that the mere calculation of the present value of a mineral property by this or any other formula based on estimates of mineral reserve, profit per ton, and plant capacity, may lead to grave errors unless careful and mature judgment is brought to bear on the factors involved in appraisal. There are factors on every side which, though they do not enter directly into the figuring, have great leverage. The major variables encountered are: price range during life of property, cost of added plant capacity, effect of increased production on the market for product, physical difficulties such as labor supply and water supply, general economic trends, and more or less regimentation by Government in these days of national emergencies. It is within bounds to say, in fact, that the main problems in the valuations of new mines lie entirely outside these dry formulas of calculation, and are found in the geological appraisal of the chances for more ore than meets the eye, or in the perplexities of estimating operating and capital costs, and market trends.

The valuation opinions arising from the Hoskold formula are sometimes surprising to both the buyer and the seller who have, it would seem for too many years, been following the simpler methods of Yankee horse-trading. Generally speaking, the present value of a mine increases, to be sure, with its reserves. However, with a given plant capacity further increase in reserve does not increase the present value as much as might be casually expected. As a general rule, reserves which give a life of about 30 years are found to be the limit beyond which the present value is not greatly added to unless plant capacity be increased. It has been a convention that the estimated life period shall not be more than 30 years. Though the orebody may assure a certain production for 50 years, the annual dividend is usually computed as continuing only 30. The present value of a dividend that is not to be realized until after 30 years is so small as to be negligible. With the same ore reserve, the difference between the value of a property having plant capacity that will give it, say, a 60-year life, and the value of the same property if its plant be large enough to give it but a 30-year life, is marked. The shorter, 30-year, life results in a present value figure of approximately 35 per cent of the sum total of operating profits that will be accumulated from the property (interest rates being

[1] "Mine Examination and Valuation," 2d Edition, 1939.

taken at 5 and 8) as against a present value of about 20 per cent only of the total operating profits of a 60-year program. When properties are equipped with plant capacity that results in 15-year exhaustion, the present value figure becomes a much higher percentage of total operating profit (52 per cent) than does the present value figure for the 30- or 60-year period (35 and 20 per cent) respectively.

Incidentally, it is perhaps worth noting[2] that the rule-of-thumb market valuation of many mines at "ten times earnings" requires a life of 15 years to return the principal and pay interest even at the moderate risk rate of 5 per cent and a sinking fund rate of 4 per cent or 22 years at 7 and 4 per cent. In absence of known ore reserves adequate for the length of life necessary to justify this ratio, these popular valuations rest upon expectation of additional ore, or higher grade ore, than is apparent in the current position of the deposit.

This question of prospective or additional ore brings up the matter of "geologic ore," that part of the value of a mine that must be based on shrewd, sound geologic appraisal. In his inaugural address to the Society of Economic Geologists, (February, 1939) D. H. McLaughlin proposed three categories of orebodies from an appraisal point of view:

1. Plenemensurate orebodies—those capable of being fully measured and sampled at an early stage in the operation.

2. Partimensurate orebodies—those in which prospects for ore in addition to proved reserves remain a substantial element of value until the later stages of operation.

3. Extramensurate orebodies—those difficult to explore and measure much in advance of mining, in which the value of ore prospects based on geologic evidence exceeds the value based on proved reserves throughout most of the operating life.

This classification aptly brings out the incontrovertible fact that except for deposits that fall definitely under Class 1, mining appraisals must take into account "geologic ore" if they are to be of practical value. At times tonnage and grade of such "geologic ore" can be determined with considerable degree of dependability by projection of the known oreshoots to reasonable limits, by structural correlations of various sorts, and by other forms of geologic evidence. As noted by McLaughlin, "attempts to express 'geologic ore' of this sort in precise terms need to be carefully qualified to avoid giving false impressions; but in some cases it may be permissible to estimate possible tonnages and metal content in round figures, based on clearly stated assumptions, and to reduce the indicated profits to a properly conservative present value by using the higher interest rates that would be commensurate with the risk that is involved."

A run-of-mine example of the conservative working out of the Hoskold method of valuation may be referred to here, to bring into view the objections voiced by sellers to some of the prices derived from the present-worth formula: This is a gold mine[3], with 500,000 tons reserve, average values about $9.50 per ton, and net profit carefully worked out at $2.25 per ton. An annual net profit of $125,000 is believed assured for 9 years' life. At 4 per cent compounding, and a modest 10 per cent risk rate, this total 9-year dividend of $1,125,000 works down to $642,500 as present value. The owners are perhaps entitled to a bit of a shudder, on first blush, when told that this property with a gross ore content of slightly below $5,000,000 should sell for $650,000. Nevertheless, the greatest amount of money a buyer content with the risk rate of 10 per cent on his purchase is justified in paying for this mine is, under its carefully ascertained characteristics, not much more and not much less than this figure of $650,000. This is another way of saying that the income from more than 40 per cent of the ore in the property is slated for being written off to pay for insuring the investor in his venture into the risks inherent in the mining business.

Other Formulas — Modifications of the Hoskold formula have from time to time been suggested by students of mine valuation on the ground that the Hoskold premises do not cover the situation and that the Hoskold calculations tend to evaluate at prices that err toward the low side. Despite the fact that the weight of accredited opinion does contend that the Hoskold premises logically combine, and best express, average consideration in the majority of mining valuations (as distinct from petroleum) involving more or less definite incomes, there exist several modified formulae of Hoskold nature that evidence sound logic. O'Donahue (1906) offered a corrected formula that covers the situation in which deferred annuities (earnings) are involved, his premises agreeing in all other respects with Hoskold's. O'Donahue pointed out that abnormally low present values are given by tables calculated at compound interest when the deferred period (before profitable production) exceeds a few years and when high risk rates are necessary.

It is true that the Hoskold two-rate formula, as such, applies only to the active life of the dividend or annuity. Expressed as

$$V_p = \frac{A}{\frac{r}{(1+r)^n - 1} + r'}$$

it provides for simple interest at the hazard or risk rate r' and for the accumulation of a sinking fund at compound interest at the lower or security rate. When deferment was recognized, Hoskold confined this basic equation with compound interest discount for the deferment period at the risk rate r', the formula becoming:

$$V_p = \frac{A}{\frac{r}{(1+r)^n - 1} + r'} \times \frac{1}{(1+r')^m}$$

m being the number of years of the deferment period.

O'Donahue's formula for present worth is:

$$V_p = \frac{\frac{A\,[(1+r)^n - 1]}{r}}{1 + r'\left[\frac{(1+r)'^n + m - 1}{r}\right]}$$

Morkill (1918) disagreed with the Hoskold premises on the entirely logical ground that it is not proper to provide interest for the investor upon the whole of the original capital throughout the annuity life (mine life), because this capital is being progressively returned to the investor. Morkill argues that the risk rate of interest should be expected only on the amount of capital remaining unreturned and that therefore the two parts of the dividend should be not constant but varying, the amount of risk rate interest annually decreasing and the dividend portion allotted as the return on capital correspondingly increasing. Employment of the Morkill formula, like the O'Donahue, results in higher figures for present value.

Comparing his formula with the Hoskold, Morkill[4] states:

"The Hoskold formula provides for an income at risk rate each year on the original capital, irrespective of the fact that an annually increasing amount of it has been removed from the venture on which the risk rate should be paid.

"The new formula provides for an income risk rate on the unreturned capital and at security rate (or as the investor may elect) on the returned capital, the combined income varying from risk rate to security rate according as capital is removed from one class of investment to the other."

The Morkill premises result in a formula that finally takes the ordinary form for the present value of an annuity at a single rate of interest, and becomes, in Baxter Parks symbols:

$$V_p = \frac{A\,[(1+r')^n - 1]}{(1+r')^n\, r'}$$

The *Grimes-Craigue Three-Rate* formula (1928) employs three rates

[2] "Geological Factors in Valuation of Mines." By Donald H. McLaughlin, 1939.

[3] Example taken from T. Hoover's "Economics of Mining," where reference may be made to extended discussion of the principles involved.

[4] "Formulas for Mine Valuation." D. B. Morkill, *Min. and Sci. Press*, Vol. 117, page 277.

of interest instead of the two of the Hoskold, the extra rate being a "semi-speculative" one, of size intermediate between the risk rate and the safe or compounding rate. This third rate is applied to the amount of capital in the sinking fund at the beginning of the year, and is based on the theory that possible diversion of the sinking fund to purposes other than to the return of capital, without the investor's consent, justified a demand for a rate of interest higher than the compounding rate but less than the speculative rate upon unreturned capital. This Grimes-Craigue formula is one that can be used in both oil and mining valuations, inasmuch as it evaluates annual sums of changing amount. It takes the involved final form of:

$$V_p = \frac{A\,[(1+r'-r''+r)^n-1]}{r'\,(1+r'-r''+r)^n-r'+(r'-r''+r)}$$

r'' being the semi-speculative rate.

Oil operation is distinguished by the fact that its revenues taper off as the years go by, whereas ore and coal deposits, once equipped, tend to approximate uniform output until exhaustion of reserve. Petroleum and gas valuation employs a special single-rate discount method of its own in which the desired rate of yield is each year applied to that portion, only, of the original capital remaining invested. Oil valuation practice was discussed by Lyon F. Terry in the paper mentioned at the beginning of this article. The method for petroleum or natural gas involves estimation of recoverable reserves for each future year of the structure's life, the production capacity and rate, and the market outlet. Net revenues for each year are worked out in expectancy, with due regard to costs of development, royalties, operation, and overhead. The present worth of these diminishing future net revenues is reached by applying to the estimated return for each year a factor (derived from proper valuation tables) representing a sum which, if invested from the date of valuation to that year, with compound interest at stated rate, will amount to one dollar.[5] The total of these discounted yearly net revenues becomes the present worth of the oil property on the basis of the characteristics estimated and assumed, and this present worth is the exact price at which the property could be purchased with the expectation that the investment would be repaid with the stated rate of interest if the net revenues prove to be as estimated.

The well-known Michigan System of Mine Appraisal, often referred to as the Hoover or Finlay Method, applied annually to some 50 active mines and explorations and 100 idle properties in that State, follows the Hoskold present-value method and formula, but the Michigan Tax Commission sets the two rates of interest at 6 per cent flat. In this respect it resembles the single-rate practice of petroleum appraisal. This 6 per cent is of course a low rate from any standpoint of speculative return, but the Michigan Commission's field appraisals are conducted with maximum effort toward elimination of the speculative features of the valuation. This appears fair to the mine owner, but it is a procedure that arrives at relatively higher valuations of the properties[6].

J. H. Curle ("Gold Mines of the World, 1899) offered a rough method of mine (or mine share) valuation which has some repute as among the more liberal systems; it leans loosely toward high valuation. He proposed to justify market valuations that could be shown not in excess of present worth by more than 50 per cent, the yield on investment (risk rate) being taken at 15 per cent. Gunther and Godfrey point out that most engineers will agree fairly well in regard to the quantities of developed ore and of probable ore in any mine, but that great differences are to be expected in estimates of possible ore. Curle offered an interesting method by which to evade such predictions, in his suggestion to purchase mines on the basis of the definite ore reserves plus a royalty for all ore afterward discovered.

One will hear it objected that rigid adherence to conservative valuation formulas will strangle the discovery and development of mineral deposits and tend to check the growth of the mining industry. It would be perhaps nearer the fact to bemoan the possibility that under the looser, more prevalent, hit-and-miss valuation and speculation existent in the mining business in the past, more capital may have been expended on mining than has been recovered in metal. It is probably within bounds to say, moreover, that there is little likelihood that mining, as a business, will ever be put on the same investment footing as certain staid but no more basic industrial developments that have created the American business structure, as for example the utilities, railroads, and heavy chemicals. Apparently there will always be money to spend on wildcats, be they gold, yellow, or black.

In conclusion, despite aggrieved opinion here and there that Hoskold evaluation technique is too conservative, and the further fact that these refined calculations are sometimes completely upset by broad changes in market prices and unexpected improvements in character of deposit, it is for the mining engineer to continue to evaluate on the facts in hand, restraining conclusions to the most conservatively scientific basis, and with due consideration of the risks in his industry. The present value method based on the Hoskold formula remains the soundest course for mineral valuation when, and in the degree that, its essential factors can be ascertained.

Since this was written, excess profits taxes have been proposed, at Washington, that bear with particular heaviness on the mining industry. A 25 to 50 per cent surtax on corporate excess earnings is called for, with a choice of two ways of calculating what constitutes "excess." One option defines as normal base 95 per cent of the average profits for the four-year period 1936–39; one red-ink year to be figured as zero. Second option, invested and borrowed capital, allows an 8 per cent credit. Due to the "wasting-asset" nature of the industry, profits in mining are not profits until after original capital has been amortized. New mining developments have hazards and losses which necessitate, in the successes, more than ordinary return on the investment, in order to make up a fair average. Thus these new taxes virtually confiscate the mine which, developed during the base period, may now come into production.

[5] "The Valuation of Oil and Natural Gas Properties as Distinguished from Mines," by Lyon F. Terry, Department of Petroleum Economics, Chase National Bank.

[6] Details of these various valuation formulas as well as a full discussion of the Michigan State System, and a comprehensive bibliography covering references of recent years in this valuation field, are to be found in the second edition (1939) of "Mine Examination and Valuation," by C. H. Baxter and R. D. Parks.

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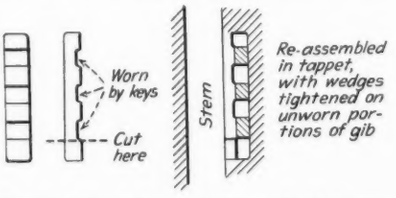
Stamp Tappet Repair

SLIPPING TAPPETS due to badly worn gibs were causing much loss of time on a stamp battery and, owing to a sunk shipment, spares were not available, this according to Harry Penfold, chief engineer, Tanganyika Minerals, Ltd., Chuna, Tanganyika Territory. He writes that he softened the gibs and cut 1½ in.



from one end of each, and then rehardened the gibs in oil. The gibs were then fitted in the tappets with the piece cut off at the other end, thus bringing unworn portions opposite the keys. Since then the tappets have been holding perfectly well for some months and, although spares are now at hand, it will not yet be necessary to fit them.

Mine Haulage at Conda

Use of battery locomotives and large cars features underground transport at Anaconda's phosphate property in Idaho

C. D. Woodward
Chief Engineer
Anaconda Copper Mining Company
Butte, Mont.

WHEN the Anaconda Copper Mining Company began development of its phosphate-rock deposits in southeastern Idaho in 1930, considerable attention was given to the selection of grades and track curvatures to permit the use of large cars and storage-battery locomotives.

The entire production of about 500 tons per day is handled through an adit of approximately 8,500 ft. in length from the mining area to the surface bins. This adit is of 9x9-ft. section inside of timber and is driven on a grade of 0.44 per cent in favor of the load. The track is 36-in. gage and of 60-lb. rail, with standard crossovers and switches, and is well ballasted and thoroughly drained.

The phosphate rock is loaded into side-dump roller-bearing steel cars equipped with automatic MCB-type couplers. Cars have a capacity of 10 tons of rock and are hauled from the inside loading pockets to the mill bins in trains of 10. A loaded train without the locomotive weighs about 185 tons, which, when moved at an average speed of about 4 miles per hour, permits seven round trips to be made in two 8-hr. shifts.

Two 20-ton General Electric storage-battery locomotives are used in this service. The locomotives are constructed with frames outside of four steel-tired wheels driven by two single-reduction geared 250-volt railway motors. Energy is supplied by 88 lead cells of 33 plates each having a capacity of 90 kw.hr. and mounted in two well-ventilated and insulated compartments on top of the locomotives. A special controller permits the motors to be connected through resistance into four-series arrangement with battery for starting, and finally four parallel points for acceleration. A motor-driven compressor supplies compressed air for brakes, bell operation, and track sanders.

Battery charging is provided for by a two-piece 50-kw. 275-volt motor-generator installed in the locomotive barn outside of the mine. During off-shift periods the generator is connected through a two-point receptacle that isolates the battery circuit from the circuits on the locomotives. An overload trip which functions in conjunction with the contact ampere-hour meter interrupts the supply circuit in case of trouble or when the battery is fully charged.

Inasmuch as all mining is carried on above the adit level, a secondary haulage system is required to transport ore from the various slopes to the main transfer chute above the adit loading bin. For this service a Baldwin-Westinghouse 4-ton storage-battery locomotive is used, which hauls trains of 10 cars of 2 tons' capacity each. This locomotive has a rated drawbar pull of 1,000 lb. at a speed of 3½ miles per hour, and hauls loaded trains weighing 40 tons a distance of 1,500 ft. down a 0.25 per cent grade. About 25 round trips in two 8-hr. shifts are made. Like the larger locomotives, the frame is outside the four steel-tired wheels, which are driven by two single-reduction geared 6-hp. ball-bearing inclosed 80-volt motors. A battery box on top of the locomotive, which is readily replaceable when necessary, contains an 80-cell nickel-iron alkaline storage battery of 30-kw.hr. capacity. In addition to a special series-parallel controller and two-point charge plug with automatic trip ampere-hour meter, a foot-operated push-button in the motorman's pit compels the motorman to occupy the seat before the locomotive can be started.

In certain development work small 18-in. gage Mancha locomotives are used to haul two side-dump 1¾-ton cars which weigh loaded about 5 tons. The average duty of this locomotive during two 8-hr. shifts is about 40 trips of 300 ft. over a grade of 0.10 per cent in favor of the load. The batteries of this locomotive, and also the batteries of the 4-ton locomotives, are charged in the mine by two small motor-generator sets.

In general, as far as the locomotives and the storage batteries are concerned, they have demonstrated that either type is able to handle the most severe conditions that are encountered in the operating schedule of the mine. Their maintenance cost has been so small compared to the total tramming expenditures for the mine that the additional accounting work necessary to separate such data is not warranted.

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Explosion Hazards in Storage-Battery Rooms

RESULTS of a study of explosion hazards in storage-battery rooms are given in Technical Paper 612, just issued by the United States Bureau of Mines. The study grew out of a cooperative investigation between the Bureau of Mines, the Boston Edison Company, and the Boston Consolidated Gas Company which has been in force for a number of years and has been carried out primarily for determining the explosion hazards in manholes, conduits, and other unventilated spaces underground. Surveys were made in connection with this investigation to determine the hazards due to hydrogen in the many large standby-type storage-battery rooms of one of the cooperative companies, and to correct such hazards when found.

This report gives the average and maximum concentrations of hydrogen present in 23 battery rooms when the batteries were being charged and when the batteries were "on float." The battery rooms were all of comparative large size, the volume of free air space in the rooms ranging from 13,445 to 86,678 cu.ft. and the number of cells in each installation varying from 82 to 344. Two or more surveys were made in each room during the investigation, covering about four years. Approximately 5,000 samples of battery-room atmospheres were taken and analyzed.

The investigation showed that the concentration of hydrogen in battery rooms was low and no hazards were involved when the batteries were idle, "on float." Under this condition, the concentrations of hydrogen varied from zero to a maximum of 0.29 per cent.

The only cases where hazardous concentrations of hydrogen were present were during the periods when the batteries were being charged and more especially toward the end of the charging period. The highest average concentration of hydrogen in any room tested was 5.35 per cent and was in the explosive range of hydrogen-air mixtures.

The results showed that mechanical ventilation is the more satisfactory method of ventilation.

MORE FACTS ON Mechanized Loading

Four operators in the United States and Canada give their experience and views

WORTH-WHILE contributions on the subject of mechanization of underground loading in metal mines were presented in *E.& M.J.'s* "Small-Mine Number," published in August, 1940. Operations in New Mexico, Colorado, and Oregon, respectively, were covered, the gist of the writers' opinions being that mechanized loading had proved useful in their relatively small properties. In this issue four other mine executives tell of the position occupied by mechanical loading in the properties in their charge. These are larger than those dealt with in the August number.

Mechanical Loading Affects Tramming and Hoisting

J. A. Wilcox
Superintendent
Shattuck Denn Mining Corporation, Bisbee, Ariz.

OUR EXPERIENCE with underground loading machines emphasizes the benefits as well as some disappointments derived from their use.

Many mines that adopted mechanical loaders already had motor transportation. In the case of Shattuck Denn we purchased the loaders first and then found we were in the position of the man who bought a horse but had no saddle, harness, or buggy. A man working by hand needs two cars—the mechanical loader needs twenty or more. Then we found that to tram by hand required so many men that they had our haulageways congested; the answer was mechanical trammers.

The point I am stressing is that if the haulage distance is other than very short, the installation of mechanical loaders forces the adoption of motor transportation and the acquisition of extra cars. Also, this necessitates double-tracking or extra crosscuts to provide passing and switching facilities. Without the necessary tracks, motor haulage, and plenty of cars, mechanical loading will be held up by a bottle-neck in the operation. The arrival of a motor at the station with ten or more loads, and needing an equal number of empties, also requires a well-scheduled hoisting plant. Skips and pockets are a valuable aid, but where cars are handled up the cage, a well-balanced schedule of hoisting and tramming must be in effect, or many stoppages in the operation will occur, with resultant cost. All the factors just mentioned result in large investment as compared with two cars, a pick, and a shovel.

As to the effect on mining, a mechanical loader well serviced can clean three drifts provided they are reasonably contiguous. To move the machine to widely separated faces involves too much time and often holds up other work. Consequently the plan of development must be laid out to provide enough faces fairly close to one another to keep the machine and its crew busy for a shift. This is not always feasible. Furthermore, it is not economical to move the loaders into faces where small rounds are blasted; consequently we desire long round drilling. In very hard ground this cannot always be accomplished. Expensive equipment, as well as men, must be kept at work and isolated, and small jobs do not fit in with the scheme of mechanical loaders.

In addition to all the conditions and circumstances mentioned in the foregoing, sight must not be lost of the investment in parts for the several machines, and the servicing and repairs that are needed.

The use of loaders alone did not reduce our rock handling cost; but with the aid of motor trammers and additional cars, the cost has been materially reduced. Indirectly, the mechanization also brought to our attention inefficiencies in mining and hoisting methods, which, after correction, have made a saving. We would not want to go back to hand loading; neither would we consider mechanical loading without due consideration of the many factors in mining, tramming, and hoisting that are involved.

Loading Machines Used For Development Headings

John J. Curzon
Manager
Howe Sound Company, Chelan Division, Holden, Wash.

PRODUCTION at Howe Sound amounts to 2,000 tons of ore per day. Broken ore, after passing through bulldozing chambers, flows directly to ore passes connecting with loading chutes on the main haulage system to the mill.

Mechanical loaders are used for development headings only. Two air-powered mucking machines are used

with 1-ton cars in 6x8 ft. development headings. One slusher-type loader, built in the company shops, is operated by a 15-hp. double-drum electric hoist. This loader is used in the 10x10 ft. main haulage level. Air-operated mucking machines are preferred for small headings, but electrical power is desirable for large headings.

Mechanical loaders undoubtedly speed up drifting operations if empty cars are supplied quickly to the machine. If sufficient cars are not made available, the effect of the loading speed per car is lost. Loaders can often be used to advantage where several rounds have been drilled and blasted in near-by faces which can be cleaned up on the following shift. Mechanical loaders have not affected our blasting program, because all blasting, except that in bulldozing chambers, is done electrically at the end of the shift from centrally located blasting panels. The transportation and hoisting systems are unaffected, because we do not hoist any ore and are well equipped on the main haulage level to handle ore to the mill or waste to the dump, as the case may be. Our use of mechanical loaders has not resulted in a decrease in employment, as the men have been available for other work. Maintenance costs and comparative costs of mechanical vs. hand loading are not available.

Loading Machines Cut Costs At Three Canadian Properties

J. P. Norrie
General Manager
Malartic Gold Fields, Ltd., East Malartic Mines, Ltd., Perron Gold Mines, Ltd.

THE THREE PROPERTIES under my management lie in the Malartic and Pascalis gold districts of Quebec, approximately 30 miles apart. East Malartic produces 1,500 tons of ore daily; Malartic Gold Fields, 500; and the Perron property turns out 600.

Eight underground mechanical loaders are in use at the three mines. At East Malartic two No. 12 Eimco shovels are used in small development headings, loading 1-ton cars. One No. 20 Eimco loads 3-ton Granby cars in large development headings. At Malartic Gold Fields we have two model 9 Gardner-Denver shovels, and one No. 12 Eimco, loading 1-ton cars. The equipment at Perron consists of two Model 9 Gardner-Denver loaders and 1-ton cars.

The daily schedule of loaders is extremely varied, as they are used for mucking from drifts, crosscuts, and stopes on various levels. A typical performance would be mucking 65 cars per day from faces on three levels of the mine. Loaders are not used for stope mucking at the East Malartic property.

Mechanical loading is well adapted to all mining methods for development headings, including drifts, crosscuts, and raises.

At the East Malartic plant and Malartic Gold Fields mechanical loading is not adapted to stopes after backs have been broken down. At Perron mechanical loading is used to muck flat 30-deg. stopes up to 25-ft. from the level where the muck is scraped to the level, mucking 85 tons per shift. We consider mechanical mucking particularly well adapted to raises 40 deg. or steeper where the muck is kept fairly well cleaned up. Chute costs are saved. Where the raise is kept open it is easier to get supplies of timber and steel to the face and much easier for surveyors in doing their work.

Mechanical loading has had no effect as yet on production at East Malartic and Malartic Gold Fields; at Perron considerable stope mucking is done, which somewhat increases mine production. Mechanical loading decreases the total number of men employed, increasing the number of skilled, and decreasing the number of unskilled, workmen.

At all three properties mechanical loading costs are varying from 25c. to 30c. per ton, approximately one-half the cost of hand loading, which varies from 48c. to 58c. per ton. At East Malartic and Malartic Gold Fields mucking costs per foot of drifts and crosscuts were reduced from $3 to $2 per foot; at Perron mucking costs in smaller headings were reduced from $2.43 to $1.37 per foot. Maintenance costs vary from 3c. to 5c. per ton, depending on the tonnage of ore that is handled.

The use of mechanical loaders has not materially lowered our transportation costs. This could probably be done along with increased loader capacity by increasing the car capacity, thus reducing the handling charges at the loader and dump. Generally the tonnage handled by mechanical loaders is small in comparison to the total tonnage, so transportation costs would in any case be little affected by the use of loaders.

Air-operated mechanical loaders have been used at our mines for the last two years. Our development and stope preparation work has been speeded up while mucking costs on this work have been cut in half. I believe longer experience with mechanical mucking will further reduce costs.

Mechanical Shovels and Scraper Slides at Miami

R. W. Hughes
Mine Superintendent, Miami Copper Company, Miami, Ariz.

UNDERGROUND LOADING machines in use at Miami comprise scraper slides and mechanical shovels. Three double-drum scraper slides with 51-in. scrapers and 25-hp. electric motors are used in haulage headings for mucking into 86-cu.ft. cars. One double-drum scraper slide with a 30-in. scraper and 10-hp. electric motor is used for mucking 30-deg. inclined shafts. Another double-drum 30-in. scraper slide with a 7½-hp. air motor is used for drifts. Five Gardner-Denver mine car loaders are air-operated.

The daily schedule for use of this equipment varies greatly according to requirements. Most of it is used two shifts, and the portable equipment is used in more than one heading. Mechanical loading has had little effect on mine output, as most of the production is by caving and gravity loading. Seven double-drum slushing outfits with 42-in. scrapers and 20-hp. electric motors are used for mining purposes. Effect of mechanical loading on mine employment has been minor, due to the mining system used. Cost of mechanical loading is less than that of hand loading, but the chief advantages are in speed and ease of doing the work. The drilling and blasting cycle has been decreased under mechanical loading, but there has been no effect on transportation and hoisting systems. Both air- and electric-operated loaders are in use. Maintenance is lower on the latter, and the power output is steadier. Nevertheless, conditions occasionally demand air-operated machines.

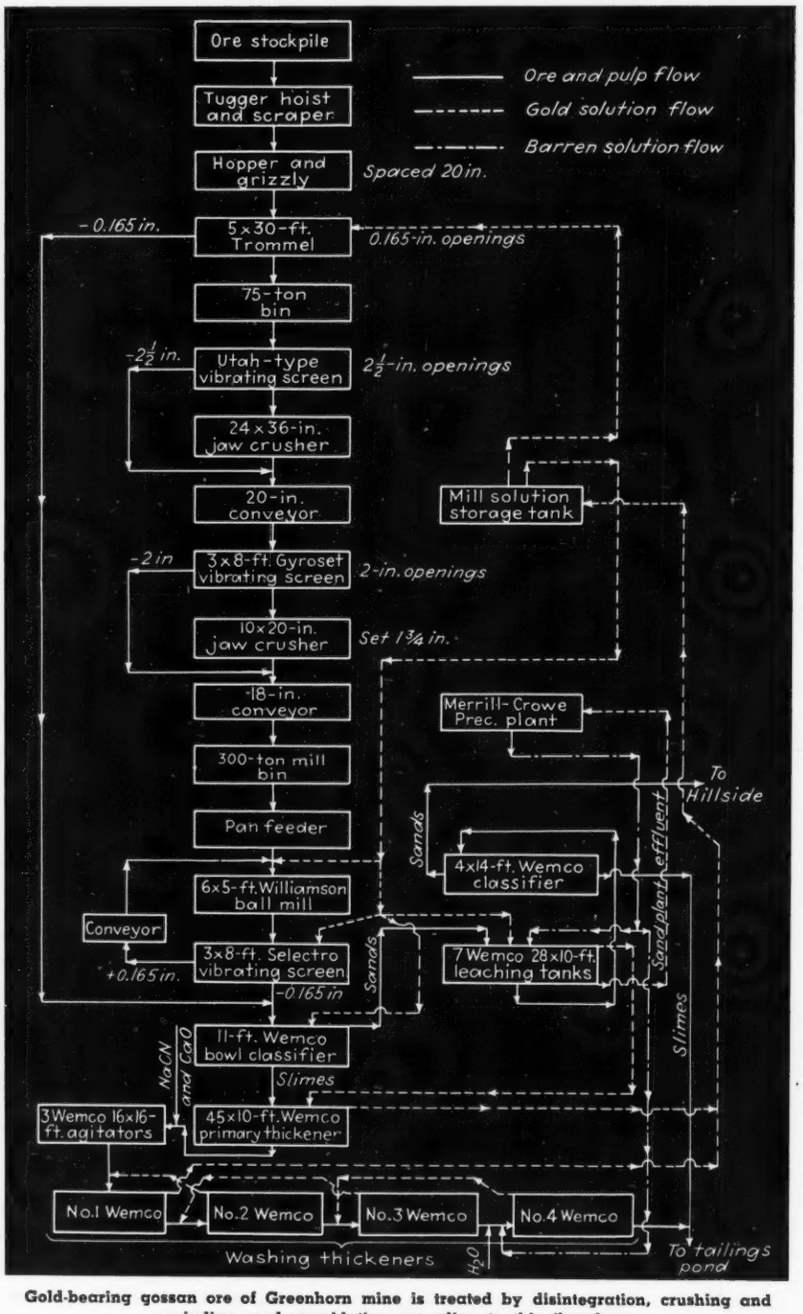
Working a Gossan Gold Ore with Modern Earth-Moving Equipment

Selective mining necessitated by barren areas at Willow Creek company's Greenhorn mine . . . A 300-ton cyanide plant treats the output

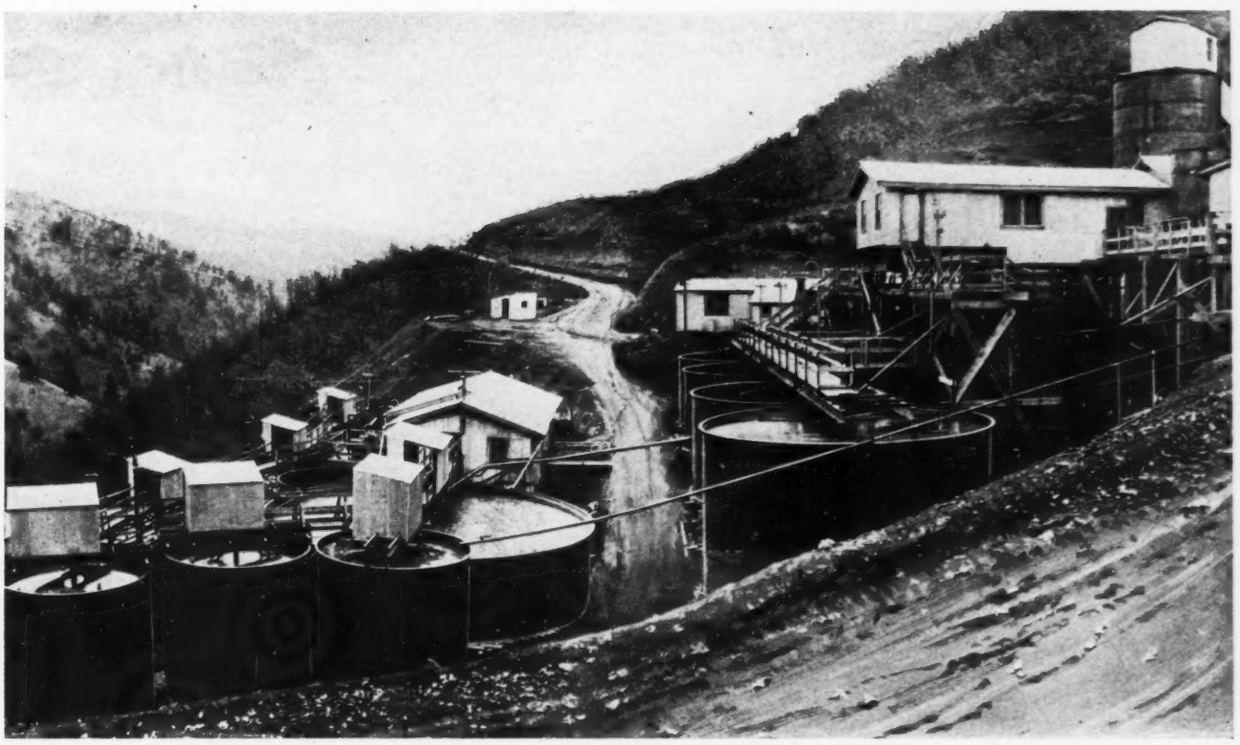
John B. Huttl
Assistant Editor

OPERATIONS of Willow Creek Mines, Inc., in Shasta County, Calif., provide an interesting example of the part played by improved cyanide methods and modern earth-moving machinery in the profitable exploitation of a low-grade gossan ore on a moderate scale. The property, known as the Greenhorn mine, developed during the World War for the production of copper ore, is about 23 miles northwest of Redding near U. S. Highway 299. In the northern part of the mine opened by several adit levels and extensive lateral work there is a large, flat-lying lens of pyritic ore closely resembling the orebodies formerly mined in the Keswick-Kennett area near the Shasta dam site, from which shipments of high-grade ore were made to the Tacoma smelter during periods of high copper prices. In 1937, the Greenhorn Mining Company, of San Francisco, obtained a $20,000 R.F.C. loan for developing the mass of gossan ore overlying the sulphide orebody. Willow Creek Mines, Inc., of which Walter Lyman Brown is president, leased the property in March, 1939, after completion of a comprehensive sampling campaign and extensive metallurgical test work to determine an appropriate flowsheet.

A contract for the erection of a 300-ton cyanide mill was let to Western-Knapp Engineering Company in May, 1939, and it was completed Dec. 1. During this period some 180,000 cu.yd. of overburden was stripped, and a churn drill operated to test the limits of the orebody and prove sections of the mine not yet developed. These stripping operations uncovered a tonnage of ore sufficient to run the projected mill at capacity for more than six months. Total ore reserves reported by W. H. Blackburn and the late R. C. Eisenhauer as in the neighborhood of 200,000 tons have since been increased to 300,000 tons. The mill, after a brief adjustment and tune-up period, commenced continuous operations on Feb. 1, 1940.



Gold-bearing gossan ore of Greenhorn mine is treated by disintegration, crushing and grinding, and cyanidation according to this flowsheet



The 300-ton cyanide plant of Willow Creek Mines, near French Gulch, Inc., Shasta Country, California

The orebody currently under exploitation is a mass of gossan of varying thickness containing localized areas of practically barren altered rhyolite (footwall rhyolite with values has been encountered). Gossan and underlying secondary copper are sharply defined. Mineralization is somewhat irregular, and the principal values contained are gold and silver, though flakes of native copper are found occasionally. This native copper causes no difficulties in the mill. The gold particles are extremely fine, almost microscopic. The gossan is friable, and in hardness varies from medium hard to hard in areas with iron capping. Gold and silver contained average about $4 per ton. The current overburden-ore ratio is about $3\frac{1}{2}$:1.

In laying out the pit, the management gave careful consideration both to the mining methods and to selection of modern earth-moving equipment. Because of the barren areas mentioned previously, selective mining was indicated, and the choice of earth-moving machinery was limited to power shovel and trucks and large Carryalls hauled by diesel-driven tractors. As a relatively large operating area was available in the pit, Carryalls were selected, which have proved satisfactory in every way. Removal of ore and overburden is done under contract by the Maeco Construction Company, of Clearwater, Calif., with a company pit inspector supervising mining operations. Distance from the pit to the mill stockpile varies from 1,000 to 1,500 ft. The economic haulage limit for the Carryalls has been found to be around 2,200 ft. Opening up of new haulage roads and maintaining those already established in the pit area are in the hands of the contractor. Excavating equipment used includes two 14-yd. Carryalls, four Caterpillar tractors, some with bulldozers, and a rooter. Save for the tractors, all are of LeTourneau make. Mining operations in general are conducted on a one-shift basis, with some 330 tons of ore being sent daily to the mill. Overburden stripped by the Carryalls is transported to the rim of the pit along Willow Creek, and subsequently pushed over the step bank by a bulldozer.

Removal of overburden requires no blasting, though some sections of the pit occasionally must be rooted. However, this is not the case in mining the gossan, in which operation drilling and blasting is frequently necessary. This work is carried out by one man. All drilling is done with jackhammers using $\frac{7}{8}$-in. hexagonal steel with Timken detachable bits, the air for the drill being furnished by a small portable compressor. The holes are drilled to a depth of 6 ft. To prevent caving in the slope area of the pit (slope 1:1), careful blasting is essential. As a consequence, the holes are not sprung and are loaded with a light charge of 30 per cent bag powder, which is detonated electrically. In some instances blockholing of large boulders is required to meet the specifications, which call for material 18 in. or less in size.

Investigation of unexplored areas is done by churn drilling, gasoline-driven Keystone 71 drills with 6-in. bits being used. Such a campaign is now being started south of the present workings. The drill crew consists of a driller, helper, and a sampler, and the average footage drilled per shift is 35 ft. The depth of the holes seldom exceeds 200 ft., and casing is used only for the first 20 ft. Extracted sludge is cut to proper sample size in a special sample cutter available at the drilling site. All sampling is done under the supervision of the pit inspector. The 10-ft. sample holes drilled with jackhammers are divided into two 5-ft. samples, and, apart from these, channel cuts are taken in areas under exploitation or to be mined, and four grab samples from each Carryall. Jackhammer drilling for samples is done with the same equipment used in blasting, but the company employs its own driller for sampling. The contractor superintendent and the company pit supervisor endeavor to work out programs whereby there will a minimum of interference and each may take advantage of the drilling done by the other.

The 300-ton mill is on a fairly steep hillside, and is modern in design and construction. Treatment involves disintegration in a trommel screen, two-stage crushing, grinding, leaching of sands, and agitation of slimes, all in cyanide solution, as shown in the accompanying flowsheet.

Carryalls dump the ore on a stockpile capable of holding 2,000 to 3,000 tons. A cut, dug some 8 ft. below the surface contour, provides a path

for the travel of a 1-ton capacity V-type slushing scraper. The Carryalls do not dump directly into this cut, as this would pack the ore too tightly, but twice a day a tractor with a bulldozer blade pushes sufficient ore into the cut from the stockpile to meet the mill demands. The scraper is operated by a 30-hp. double-drum electric tugger hoist, using $\frac{3}{8}$-in. rope on the main line and $\frac{3}{8}$-in. rope on the haul-back. Various types of blocks have been tried. At present the tail block is a 36-in. diameter sheave mounted far enough back up the hill so that proper guides may be installed to keep the rope from fouling and off the ground as much as possible. This arrangement gives the rope a better bending characteristic, with resultant longer life and lower over-all maintenance costs. Fair-lead blocks are used to assist in proper spooling of the line. The drag is downhill on a fairly steep slope, more especially when the cut is filled.

The scraper discharges into a hopper containing a rail grizzly spaced 20 in. Oversize is sledged through, when necessary, but this is seldom the case, as the contractor is required to break the ore to pass the grizzly. From the hopper the material goes to a 5x30-ft. trommel, mounted on rolls and tires and driven at 8 r.p.m. through a chain by a 25-hp. motor. The first 8 ft. of the trommel is blanked off, with lifters and a 1-ft. annular ring at the lower end to provide a scrubbing pool. The next 11-ft. section has an inside steel shell with punched $\frac{3}{4}$-in. openings, outside of which and with a 6-in. space between there is mounted woven wire cloth of 0.120 in. diameter wire with 0.165-in. openings. This latter opening produces a finished product that flows directly to the Wemco bowl classifier for sand and slime separation. The remaining section of the trommel contains more punched steel plate with larger openings, with the last 5 ft. left entirely open to facilitate discharge of any large boulders. The trommel is directly above the coarse-ore bin, into which all plus 0.165-in. ore is discharged; and the tugger hoist is mounted above the trommel. Floodlights are provided for operation of the hoist at night.

Mill solution is fed to the hopper, as an outside spray on the woven wire cloth, and at times directly into the scrubbing chamber. It is delivered to the washing plant, which is about 75 ft. above the ball-mill floor, under pressure by a 15-hp. I.-R. motorhead pump. The minus 0.165-in. undersize goes via a 4-in. heavy steel pipe to the bowl classifier mentioned previously. Trommel screen wear has not been excessive. No replacements have been made so far, but considerable wear on lifters in the scrubbing section has been noted. Each replacement has been with heavier material.

Material withdrawn from the coarse-ore bin is conveyed directly to the crushing department. Here are available two crushers, the primary a Wheeling type 24x36-in. jaw crusher and the secondary a Universal type 10x20-in. jaw crusher. Ore is fed to the first unit through a chute with a rack-and-pinion door by a Utah-type vibrating grizzly with $2\frac{1}{2}$-in. openings. The crusher itself is set at about 3 in. on the closed stroke. Undersize from the grizzly and primary crusher product is delivered to a 20-in. conveyor belt discharging onto a 3x8-ft. Gyroset vibrating screen made by the Productive Equipment Company. This unit uses screens with 2-in. openings, the undersize going direct to the main conveyor, while the oversize is directed to the secondary crusher set a $1\frac{3}{4}$ in. The product from this crusher joins the undersize from the screen on the main belt, and goes via a 21-deg. incline to the 300-ton mill bin.

Grinding and Screening

Grinding is done in a 5x6-ft. Williamson grate-type ball mill operating in closed circuit with a Selectro vibrating screen made by the Productive Equipment Company. The screen measures 3x8 ft. and is equipped for double-deck screening. Only the upper deck is used, which is covered with a woven-wire cloth screen having 0.120-in. diameter wires and 0.165-in. openings, Undersize is pumped to the bowl classifier by a 3-in. Wilfley sand pump, and the oversize returns to the ball mill scoop box via a belt conveyor. The grates in the mill have a normal opening of $\frac{1}{2}$ in. A very low level of pulp is carried, and it is "ground-sluiced" through the mill at 50 per cent solids. Only a light load, made up of 5-in. balls, is used in the mill, every effort being made to reduce to a minimum sliming in the mill. Ball consumption is less than 1 lb. per ton of ore treated, and balls reduced to $2\frac{1}{2}$ in. or less in size are removed. Liner wear is very good, possibly because of the hard "peening" action of the heavy balls on the manganese.

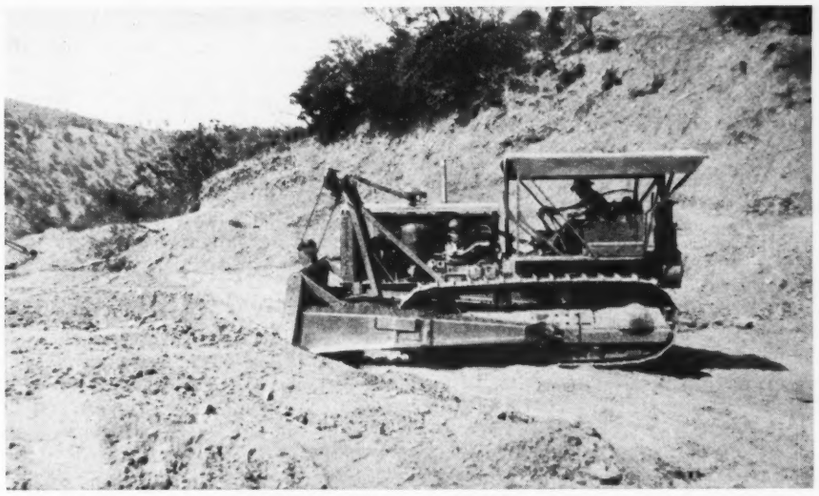
Sand and slime separation is effected in a Wemco 11-ft. bowl classifier. The bowl rakes and sand rakes are actuated by variable-speed drives. Specific gravity of the classifier overflow varies from 10 to 15 per cent solids, depending on the character of the ore treated. It contains from 10 per cent plus-100 mesh down to 10 per cent 150 mesh, with the plus-200 mesh remaining somewhat stationary at between 16 and 18 per cent. About 40 per cent of the rake discharge or sand is minus-8 mesh and 5 per cent minus-200 mesh. The sands are conveyed to leaching vats, and the slimes to the primary thickener. All washing, grinding, classification, and the filling operation are in cyanide solution.

The sand-leaching section, which handles about two-thirds of the mill feed, contains seven 28x10-ft. conventional leaching tanks, with false bottoms set on a grade of $1\frac{1}{2}$ in. per foot. The cycle requires seven days—namely, 1 day for filling, 1 for discharging and preparation to receive a new charge, and 5 days of actual leaching. All tanks are partly filled with solution before the sands are charged. These are washed into the tanks with solution, the overflow going to the primary thickener or to the washing section as required. Leached sands are discharged through a center valve with water and residues from the slimes section. A 3-in. Kimball-Krogh sand pump connected to the leaching tank pipe system delivers the pulp against a head of 140 ft. to a Wemco 4x14-ft. classifier, the frame of which is mounted on car wheels, with the whole unit being carried out over the hillside on track laid on stacked sands. The rakes operate at 28 strokes per minute, and sands are discharged onto a 14-in. conveyor belt running at 200 f.p.m. This belt, together with the drive mechanism and motor, is mounted on a frame which pivots back of the tail pulley. The outer or head end is supported by guy ropes secured to the classifier with a block and tackle to permit raising or lowering the head end. By this means the conveyor may be swung through a horizontal arc of some 160 deg., and raised or lowered from below horizontal to any angle at which the sands will stay on it. The object of the classifier and stacking conveyor is to remove all plus-28-mesh material from the leaching plant residues, experience during initial stages of operation having demonstrated this as being more efficient and economical than pumping the entire sand residue to the tailings pond. The classifier overflow goes to the tailings pond about 2,500 ft. distant and 150 ft. lower in elevation, where the remaining sands are separated and a tailings dam is being built in the conventional manner. Coarse sands are stacked on the hillside.

As shown in the accompanying flowsheet, the mill is of conventional design, with the possible exception of the washing section. Equipment available in the slimes-treatment department includes a 45x10-ft. primary thickener, three 16x16-ft. Dorr-type agitators, and four 40x10-ft. washing thickeners. All thickeners are equipped with centrifugal sand pumps for elevating thickened underflow pulp. Primary thickener underflow around 33 per cent solids by weight is transferred to the agitators, where it receives 24-hr. agitation in strong cyanide solution. Because of the slow settling rate of the slimes, with resultant crowding of the entire mill beyond its nominal capacity, it has been found necessary to employ No. 1 washing

thickener in a dual capacity, whereby it receives lighter slimes decanted from about 3 ft. down in the primary thickener as well as the pulp from the last agitator. When the proportion of slimes in the ore rises beyond the capacity of the smaller washing thickeners, the overflow from the last three of these units is permitted to become muddy, and this solution is clarified in No. 1 washing thickener. The overflow from this unit is kept clear. During this period it is necessary to bypass part of the pulp from the last agitator to No. 2 washing thickener. As this reduces washing efficiency materially, arrangements are being completed to utilize the tailings pond for a final wash of the pulp in an effort to reduce both the loss of dissolved values and chemicals.

Two 14-cu. yd. Carryalls and four Caterpillar diesel-driven tractors are used in excavation work at the Greenhorn pit. One of the Carryalls is seen and, at the right, a bulldozer tractor



Bulldozer pushing overburden over the pit bank at the Greenhorn mine

Slimes stored in No. 1 thickener are fed back into No. 2 thickener. Overflows from the primary and No. 1 washing thickeners collect in a small mill-solution sump, and are thence pumped to the main mill tank above the ball mill. The solution is used for leaching sand charges, dilution of bowl classifier, the washing section, and others.

Effluent from the sand charges contains no free or protective alkalinity, having a pH from 8.0 to 8.4, with a cyanide strength of about 0.012 per cent NaCN. The strength of solutions going on the charges is around 0.04 per cent NaCN and 0.03 per cent CaO. Effluent from sand charges only is sent to precipitation, which consists of the Merrill-Crowe simultaneous clarification and precipitation system. Clarification equipment consists of two units of six leaves each in one rectangular tank, with a partition between the two units. This arrangement permits washing one unit while the other continues to supply solution to the precipitation system. After washing, the leaves are precoated with Hy-Flo, a diatomaceous filter aid, and because of the fact that all solution going to precipitation has had what might be called one stage of clarification while passing through the sand charges, the clarification leaves need but infrequent washings. Precipitation equipment comprises two tanks with 40 bags in each fitted with the new Merrill clamping-type head. From 0.05 to 0.06 lb. of zinc dust is used per ton of solution precipitated. Lead acetate at the rate of 1 lb. per day is sometimes, though not always, added to the zinc dust. No bag pressure trouble has been experienced.

All cyanide and most of the lime are added to No. 1 agitator sufficient in quantity to keep the cyanide strength above 0.06 per cent NaCN and 0.04 per cent CaO. Lime is slaked and milked in tanks fitted with high-speed ship-type propellers, and distributed both to No. 1 agitator and the main mill tank by a small centrifugal pump. Little trouble is experienced with clogging of lime distribution pipe lines. Aerobrand cyanide is dissolved in small 500-gal. tanks also equipped with high-speed ship-type propellers, and down-draft tubes. Fitted thus, it has been found that from 12- to 16-hr. agitation will remove soluble sulphides. Sufficient supply for 24 hr. is made up at one time, there being two make-up tanks, each alternately being charged and agitated.

No promotional reagents, either to assist in further dissolution or to aid settlement of slimes, have been found useful. Recoveries are about 78 per cent of the gold and 40 per cent of the silver. Consumption of chemicals and power per ton of ore treated is as follows: Cyanide, 0.65 lb. 100 per cent NaCN; lime, 9.5 lb.; zinc dust, 0.13 lb.; and power 10 kw.-hr. No accurate estimate of water consumption is available at present, but when the reclamation system at the tailings pond has been completed it is estimated that the water loss, including evaporation and seepage, will be about 1.25 tons per ton of ore treated. Electric power is obtained from the Pacific Gas & Electric Company network at 11,000 volts, which is stepped down in the transformer station at the mill to 440 volts for plant use. Water is obtained from various sources and collected in a small concrete dam near Willow Creek, whence it is pumped to the mill by a I.-R. two-stage centrifugal pump driven by a 25-hp. motor. The head varies from 200 to 425 ft., depending on whether the water is delivered directly to the mill or to the main water tank of 150,000-gal. capacity situated 150 ft. above the mill.

Thanks are due to Walter Lyman Brown, president of Willow Creek Mines, Inc., for permission to publish the aforegoing account; and to Corwin L. Cooper, general superintendent, I am indebted for the information and data contained therein.

Operating Records FOR THE Small Mine and Mill

A system of keeping them is outlined on the basis of experience

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THE SYSTEM outlined in the following paragraphs records all the essential operating data necessary in a small mining and milling enterprise. In this type of mine the ore is extracted from underground, a concentrate is floated, and the product is sent to a smelter for final reduction. By changes in some of the records this system could be adapted to other types of mines; however, the changes would be basic and it would be necessary to draw up a new outline.

There are eight principal groups of records: the production record, the smelter return record, payroll record, general financial record, monthly statements of financial position, a cost index, a mill operation record, and a mine operation record. These records act as a check on mine production, or as a statement of financial status, or as a source of information the management uses in guiding its policies.

The production record arises largely through the assayer's efforts. From the daily assays a separate record is made for each type of product; for instance, a jig concentrate and a flotation concentrate. The dry weight produced, per ton value in dollars and cents, and total day's production value are recorded each day. When a shipment is made to the smelter the lot is weighed and assayed. The check between the daily assays and the lot assays eliminates the chance of any large error. Data needed on the lot shipments are: production dates, shipment date, wet tons, per cent moisture, dry tons, number of lot, precious-metal content, per ton value, and total value of the shipment. Though it is not so essential as the value check, it is desirable to establish a check between daily production weights and lot-shipment weights. Generally a fixed figure can be used for the per cent moisture in daily production, and the moisture test is run on each lot only. The purpose of the production record is to check the smelter returns, and in the event that there is a serious discrepancy a reconsideration can be requested.

The smelter return record summarizes and collects the data on the smelter return sheets. Information can be drawn in regard to tonnages, moisture losses, metal prices, nature of smelter deductions, freight charges, and income. In the event that more than one smelter is buying the product, the comparative advantage of each is given by this record. The essential data recorded are: to whom sent, date shipment received by smelter, how sent (number of freight car if sent by train), the smelter lot number, price received for metals, tonnage wet and dry, per cent moisture, precious-metal content per ton, per ton value, deductions (detail enough to give reason for deduction), net value per ton, total shipment value, freight charges, and net income.

The first two records discussed indicate chiefly the amount and value of production. Part of the costs of production is shown by the payroll record. A daily record is kept for mine and mill. The mine record tells the place and kind of work and includes all the men necessary to get the ore into the coarse-ore bin; the mill record tells the kind of work and includes the men necessary to crush, grind, and float the ore. The data are posted by the most convenient method to a ledger. Names are kept in alphabetic order in three divisions: mine, mill and general. All names are rewritten in the ledger each payday. The turnover of labor makes this method advisable. The information kept includes the following: name, hours, wages, advances on salary, deductions, final pay received, type of work and Social Security number. The total wage expense is posted to the cash disbursements journal each payday; cash is credited, and mine wage expense, mill wage expense, and general wage expense are debited. Or, if more detail is desired, the general wage expense can be broken up into its constituents. The payroll records should be used in connection with other records and the judgment of the supervisor in evaluating the quality and quantity of work done by each man.

The payroll record, together with the general financial records and the monthly statements, comprises the portion of the operating records with which the bookkeeper or accountant come in contact. The general financial record is composed simply of the journals and ledgers. For clarity of recording, four journals are kept: cash receipts, cash disbursements, purchases, and general. Accounts receivable are so few that they can be kept in the general journal and no sales journal is necessary to classify them.

The cash receipts journal indicates principally the smelter returns. Cash is debited and income from smelter returns or miscellaneous is credited. The cash-disbursements journal is essentially a check register. Cash is credited and accounts payable, expense, or miscellaneous items are debited. The purchases journal indicates the accounts payable. Accounts payable is credited and expense or miscellaneous is debited. The general journal is used for miscellaneous and closing entries; an expense column is included. The expense column in all of these journals is accompanied by a detail of debit section.

A general ledger and two subsidiary ledgers, accounts payable and expense, are kept. The expense columns in the journals contain sufficient detail to indicate all significant expenses. Thus the ledger expense totals can be posted directly to the monthly statements.

The monthly statements sum up the financial position of the company. Monthly statements are issued in preference to bi-annual or annual statements because of the relatively unstable nature of small mines. Frequent periodic reviews are essential to good management. A balance sheet showing the assets, liabilities, and net worth is given, and a profit-and-loss statement showing the expenses and net income is included. Detail of mine expense, mill expense, and general expense is given in total and per ton values.

Another phase of the operating records important to proper management, but not so significant as the monthly statements, is the cost index. It is built up by whatever method is expedient to facilitate economical operation. It shows the cost of supplies as received from each company. These data, together with the experience gained from the use of the supplies, enable the management to save intelligently on the various expense items incurred.

The mill operation record is kept as a constant guide to proper mill operation and as a source of information for the management. The daily record kept at the mill shows the tons of ore milled, tons of concentrate produced, amount and nature of reagents used, the man-hours worked, and other detail essential to round out the log of operations. From the mill record and the assays the daily values of the

heads, tails, and concentrates are calculated in per-ton and total values. The independent nature of getting the weights and values for the heads, tails, and concentrates acts as a check to show the accuracy of the work. As was explained in connection with the production record, daily production values are recorded and totaled for each lot shipped to the smelter. In addition, a continuous record is kept for all three—heads, tails, and concentrates. The data recorded each day for each are: dry tons produced, precious-metal content per ton, value per ton, total precious-metal content and total value. If more than one concentrate is produced, more than three sets of data would be kept. When desired, totals can be made for such items as tonnage milled, weight of precious metals produced, ratios of concentration, per cent of recovery, and so forth. In addition to this type of data, information should be compiled on machinery wear and also on replacement, to supplement the cost index.

The mine operation record shows the action being carried on to get the ore from underground into the mill bin. A record is kept of the powder, caps, and fuse used and the cars of ore and waste produced from each face, stope and chute. The number of skips of ore and waste taken out each day are recorded and translated into tons. A rough check is thus established with the mill records. When a great amount of repair and replacement work is done a record of the time and material spent should be kept. In the event that it is desired to express the value of an asset in terms of its initial cost plus the cost of installation, a fairly accurate estimate can be made. Such a record will detect the fallacy of buying second-hand equipment at a reduced price and then offsetting the saving by higher installation costs due to repair and adjustment work. A record of the accidents and injuries to men is kept.

It is desirable to develop a surface map of the mining claims that are being operated. The limits and topography of the claims are shown and it is advantageous to indicate as well the surface outcrops and the general mineralogy. The maps of the underground workings should be kept up to date. A separate sheet is kept for each stope as it goes up. A plan of each level shows the drifting and crosscutting. A working map shows a cross-section and a plan of all the work done; and at intervals a finished map is drawn up to show the work that has been completed underground.

Enough assays should be run to give a correct picture for the value of each stope; and enough grab samples are taken to show local variation. These values, together with the estimated tonnages from each stope, are put in the finished maps. Tonnages are estimated from the number of cars of ore drawn from each stope.

The records discussed give nearly a complete picture of mine operation. Graphs are useful and should be made wherever they will give a clearer picture. There is no question but that the application of this system specifically to any particular small mining and milling enterprise would call for slight changes, deletions, and additions in repect to the records, but the essential background is as given.

Blast-hole Diamond Drilling at East Malartic

Principal advantage demonstrated thus far is that it gives the miners a safer working place

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IN JUNE, 1939, the first blast-hole drilling was done at the East Malartic Mine, at Norrie, Que. The ore zone is along a graywacke greenstone contact dipping 85 deg. south and with the greenstone as the footwall of the ore. Four stopes from 100 to 180 ft. long and varying in width from 20 to 80 ft. were to be mined through to the surface. Mining had been done with rock drills carrying a breast 12 to 18 ft. high and for the full length of the stope before starting the next breast until back pillars about 60 ft. thick were left. A different method, fast and safe for ground which was now making a high proportion of "loose" in the back, was desirable.

Diamond-drill holes from slots across the ends of the stopes were decided upon. Slots were drilled out 20 ft. high and the backs were supported by timber cribs where necessary. A vertical burden of 8 to 12 ft. and a horizontal spacing of 10 to 14 ft. were given to the holes.

The holes drilled were 1½ in. in diameter and 40 per cent Polar Forcite powder was used for blasting. Most of the diamond drilling in this surface pillar was done with coring bits, as these gave less trouble than the noncoring blast-hole type bit in drilling through slips and rock fractures. The 16,000 tons of estimated slough is ore from the back of the stopes which fell after blasting diamond-drill breasts and is additional to the 60,000 tons of ore broken by diamond-drill work.

The information on the recovery of the stope surface back pillars is given for its interest but probably has no comparative value for other mines.

Only one stope in the mine, 4-5 stope, was planned for mining by diamond drills, and it is the only working place to date in which the engineering and cost data may be of comparative value. The stope is 175 ft. long, 58 ft. wide at the west end, 28 ft. wide at the east end, and has a regular ore outline suitable for good recovery by diamond-drill holes. The broken ore is handled through grizzlies with draw points at 25 ft. centers and is dropped into box holes with loading chutes on the main haulage level. Service raises were driven at both ends of the stope, and after silling had been completed, slots were cut across the stope at both ends to give breasts for diamond-drill set-ups.

The breasts averaged 18 to 20 ft. in

Table I—Data on Blast-Hole Diamond Drilling at East Malartic

Stope	Tons Broken	Diamond-Drill Shifts	Feet Drilled	Pounds Powder	Tons Estimated Slough
2–4	25,155	81	2,465	1,025	.....
2–3	19,714	66	2,309	1,090	.....
2–2	7,402	27	586	433	9,277
Sub-total	52,271	174	5,360	2,548	9,277
2–1 S	7,808	125	3,230	1,898	6,434
Total	60,079	299	8,590	4,446	15,711

	Exclusive of 2–1 S Stope	Including 2–1 S Stope
Tons per diamond-drill shift	300	201
Tons per foot of hole	9.75	7.00
Feet per diamond-drill shift	30.8	28.6
Tons per pound of powder	20.5	13.5

height. Depending on the ore width, the holes were spaced from 8 to 13 ft. apart at the collars and given 6 to 8 ft. of vertical burden. The number and spacing of holes for each breast are based on a calculation of the tons to be broken in the particular breast and the arbitrary objective break per pound of powder which gives the pounds of powder required. The number of sticks of powder which can be used per foot of hole gives the total footage of diamond drilling required to fulfill the predetermined objectives.

On the first breast over the sill an objective of 7 tons per pound of powder was decided on, but it proved unsatisfactory. The break was good, and the trace of each of the upper diamond-drill holes could be seen for their full length along the stope back, but fragmentation was poor. The larger blocks of ore had no drop or travel through the stope to the grizzly draw points in which to be further broken down, and powder consumption for secondary breaking at the grizzly level was correspondingly high.

The back holes are laid out in a horizontal row, allowing 2 ft. below the low point on the slot back to give headroom for the diamond drill. Clearance for the diamond drill must also be allowed along the stope walls. About 5 ft. of undrilled ground which breaks during blasting is left between the toe of holes of opposite breasts. Loading is done using the Noranda-type folding loading stick and blasting is done with electric delay caps.

Table II is a summary of engineering and cost data for diamond drill work in 4-5 stope.

The necessary preparatory work of slotting must be added to the work of diamond-drill stoping to give a cost comparable with similar stopes mined with rock drills. To date, any difference in cost per ton broken has been slightly in favor of the rock drill stoping. The cost of 0.268 per ton broken for slotting and diamond-drill stoping combined includes the direct charges only. To this must be added approximately 70 per cent, or $0.187, to cover the distributable mine charges, thus giving a total cost per ton broken of $0.455.

The main advantage of diamond-drill stoping as compared to rock-drill stoping is that the workmen are given a safer working place; the distributable mine charges are less; no steel and steel sharpening are required; no rock-drill repairs are necessary; and less sampling and assaying are involved. The equivalent of steel and repairs on the diamond drill are made part of the direct charge. The main disadvantage is that the control on the ore limits is not as good.

To July, 1940, tons broken in stopes and pillars by diamond drill were 147,307; by rock drill, the tonnage was 618,384.

The diamond drill has its place in breaking ore and may be used to good advantage as a complementary tool to the rock drill.

Table II—Summary of Blast-Hole Diamond-Drill Data, 4-5 Stope

4–5 Stope Diamond Drilling		Per Ton
Tons broken	69,362	
Diamond drilling	$8,456.30	$0.122
Explosives	1,524.17	0.022
Diamonds	6,242.58	0.090
Total	$16,223.05	$0.234
4–5 Stope Slotting		
Tons broken	11,968	
Drilling and blasting	$3,382.94	$0.283
Explosives	1,489.81	0.124
Bonus	426.55	0.036
Mucking	43.76	0.004
Timbering	179.70	0.015
Total	$5,522.76	$0.462
4–5 Stope Over-all		
Tons broken	81,330	
Total cost	$15,503.23	$0.268
Aug. 1, 1939, to July 1, 1940:		
Diamond-drill shifts		397
Pounds of powder		10,498
Footage drilled		14,068
Tons broken		69,362
Tons per diamond-drill shift		175
Tons per pound of powder		6.61
Tons per foot drilled		4.93
Footage drilled per diamond-drill shift		35.4
Pounds powder used per foot of hole		0.75
Jan. 1, 1949, to July 1:		
Direct cost of diamond drilling per foot drilled		$0.60
Diamond loss per foot drilled	0.068 karats	
Diamond loss per ton broken	0.015 karats	

ON

"Structural Control" of Ore Deposits

Objection to the term is made that "structure" is meaningless as a factor unless there be fracturing

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FROM VARIOUS SOURCES, and the review of the literature of economic geology for 1939, by Harrison Schmidt, in the February, 1940, number of *Engineering and Mining Journal*, it seems the term "structural control" as applied to certain steps in the development of epigenetic ore deposits has met with wide acceptance. Though I have given slight attention to the subject for quite a few years, and today my interest is all but dormant, nevertheless there is a special concern in what that term represents. My active connection with the particular phase of geology that seems to be comprehended under the phrase "structural control" definitely began in 1910, after which it became an absorbing topic for perhaps twenty years, during which, in 1924, I published an article in the *Engineering and Mining Journal-Press*, under the title "Intersecting Fracture Zones and Mineral Districts."

That article advanced some beliefs that were based on various extensive, long-continued, first-hand observations in the field. In the beginning, and before the first hint was noted in Bingham Canyon, Utah, in 1910, there had been a growing question in my mind as to whether igneous intrusions, such as are found in mineral districts, had resulted from some special development of the magma at depth, and had forced themselves through to the surface regardless of the conditions in the crust; or whether pre-existing crustal weakness had determined the location of such intrusive masses. At the time it looked a good deal like the old problem as to whether the hen or the egg came first.

A study of the topography within the district itself led to an examination of the eastern flank of the north-and-south range in which Bingham is situated. Here evidence was obvious which was a perfect continuation of some already observed within the mineral area itself; and, immediately, much previous but more or less indefinite speculation was given a firm foundation. Clearly the Park City-Cottonwood section lying in the Wasatch Range, 20 miles to the east and across the Salt Lake Valley, and the Bingham district itself, were in the same east-and-west crustal disturbance. A quick review of the earlier evidence made certain there was no mistake. But, on as large a scale as that region affords, and involving several districts, there were but two sets of general crustal disturbance involved, and, after all, the whole condition may have been peculiar and without counterpart elsewhere.

To determine if this condition was general and not merely local, more extended evidence was necessary. During

the next eleven years much observation through the southwestern United States, particularly in California, Utah, Nevada, and Arizona, proved beyond question that the Bingham-Park City instance was far indeed from being unique. Numerous mineral areas were observed where lines of crustal disturbance converged. In this work the topographical maps of the United States Geological Survey were occasionally of use; but frequently they were not available, or were drawn to such a scale, or over such a limited area, as to be useless.

Now, once the initial step was taken, it is to be observed that the fundamental idea was to determine the relation of breaking, fracturing, fissuring, to ore deposits; or more particularly to mineral districts. In doing this the topographic features, such as mountain ranges, or lesser uplifts, were observed as indicators of the presence of significant fracture systems. That is, "structural" features were used as evidence to determine the existence of such system; but the "structural" features were never anything more than a means, and were at no time objects in themselves. Such structures as were observed were the result of stresses in the earth's crust which resulted in distortion which, if pronounced enough, produced fracturing; but without fracturing "structure" was meaningless as a factor in the formation of orebodies.

Moreover, it should be pointed out, the function of fracturing is limited to but one step in the formation of ore deposits. That is, in creating ducts or channels for the ascent of solutions. Fracturing neither furnishes the solutions, nor does it supply such valuable minerals as the solutions may contain. Hence, in order to emphasize the looseness of the current expression, we might point out that, despite the importance of fissuring in the formation of ores, or, as it might be said, the "fissional" agency, it would be equally improper to adopt such a phrase as "fissional control," as the word "control" comprehends too much. If, however, "localization" were substituted for "control," an overstatement of the influence of fissuring would be avoided, and the resulting phrase "fissional localization" would not include more than the facts warranted. The phrase, however, is not suggested for adoption and is used here only as an illustration, as it is defective in the respect that it fails to connote the converging or intersecting feature involved, and its words, taken simply at their face value, state only what every intelligent miner has known for the past 75 years or more.

That this confounding of structure and fracturing is not universal is seen from the preliminary report of the United States Geological Survey, issued in 1935, on the Cripple Creek district, Colorado, where the original, primitive, significant fissuring is given the name of "master" fissures. In that document we find no confusion of thought between fractures and structures, and we have an apt word that tells its own story without further explanation. The expression "master fissures" is on a par with the older "host rock" as applied to the rock that contains an ore deposit, whoever its author may have been. Such expressions might well be characterized as "master" phrases, and some brief saying is needed that will embody the idea of converging fissure systems, or the "intersecting fracture zones" that was used by myself. In any event we should have some worthwhile phrase if only to displace the baseless and misleading generality that is now in use.

Perhaps I see the shortcomings of "structural control" under an exceptionally glaring light. The article mentioned, along with one introducing the idea of reopening fissures, and later a supporting contribution on the occurrence of inclusions in veins, had not by any means exhausted all my conclusions that conflicted with the geology of the time. Those published papers, in effect, formed a rounded group of related facts and reflections, and constituted a natural division and resting point. And inasmuch as the ideas advanced were widely at variance with the beliefs of that day, it was expected there would be some lively discussion that would open the door for the introduction of other developments. But instead there was a long period of silence, and the intended exposition has not yet smelt the odor of printer's ink. The objections that have been stated to "structural control" have therefore been confined necessarily within the limits of accepted geological conceptions; and, as a consequence, there has been an understatement that is of something more than moderate proportions. However, there seems to be no remedy for this, excepting through a lengthy presentation such as would not be possible here; and one indeed which will probably never appear except in book form, where it may pay its way and perhaps for some of the labor of the past.

Assaying Cyanide Solutions for Gold

A method using hydroxylamine hydrochloride is proposed

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A NUMBER of methods are available in the literature for the assay of gold in cyanide solutions that give dependable results within the range of their application. Nearly all of these methods, however, depend on a furnace operation or a color comparison to obtain the value of gold in solution. Both of these methods have serious disadvantages.

In recent years a number of interesting variations and new methods have appeared that indicate new possibilities in precipitating gold from solution. The method presented here attempts to improve the recovery of gold from solution by combining desirable features of some of these methods. Briefly, hydroxylamine hydrochloride is combined with zinc dust to precipitate the gold as an amalgam from either an acid or cyanide solution to which mercuric chloride has been added. The amalgam is collected and parted with nitric acid to recover the gold. This procedure eliminates the furnace operation or color comparison to obtain the value of gold in solution.

The cyanide solutions used in developing this method of assay were collected from batch cyanide tests and were assayed by the lead acetate-furnace method. See Table I for representative results obtained by the proposed method compared with those had with the customary method.

To one assay ton of solution (29.166 c.c.), or other convenient volume, add 0.3 grams of zinc dust and agitate for

one minute. Add 0.5 grams of mercuric chloride and warm on a hot plate to dissolve the salt. Add 0.5 gram hydroxylamine hydrochloride and 3 c.c. concentrated ammonium hydroxide. Boil for a few minutes to give the hydroxylamine hydrochloride time to reduce the mercuric chloride to mercury. A nearly clear solution results. Remove from the hot plate and add 5 c.c. concentrated hydrochloric acid. Boil until a clear solution results and most of the free zinc has been dissolved.

At this point fine droplets of mercury should appear and settle, although some may float attached to air bubbles. A flocculent precipitate also will appear which is difficult to settle. Destroy it by adding a few drops of phenolphthalein and make the solution alkaline with ammonium hydroxide, adding 2 to 3 c.c. in excess. Add 0.5 gram more hydroxylamine hydrochloride and boil until a clear solution results. Allow to settle, and decant most of the clear solution, being careful not to lose any amalgam. Add 10 c.c. hydrochloric acid and boil for a few minutes to clean the surface of the droplets so that they will coalesce. Dilute to about 50 c.c. and continue boiling for another minute. Stir vigorously to detach droplets of amalgam from gas bubbles, and use a stirring rod to bring most of the amalgam together in one large globule. Decant the clear liquid carefully and repeat the acid treatment to facilitate collection of the fine droplets into one globule. Wash this globule with water several times to remove the last traces of hydrochloric acid.

Transfer the globule to a porcelain cup and part with dilute nitric acid, 1—4. More concentrated acid will react too violently and break the gold sponge into fine pieces easily lost on washing. When completely parted, cool, decant the clear liquid, and add 1 c.c. concentrated nitric acid. Heat for a few minutes, dilute and decant. Repeat this treatment three or four times for large gold sponges to remove the last traces of mercury and zinc. Wash with distilled water, dry, anneal strongly, and weigh.

The method of assaying cyanide solutions detailed in the foregoing gives results that are from 3 to 5 per cent higher than those obtained by the lead acetate-furnace method. This difference corresponds favorably to the cupel losses incurred in the latter method. The procedure, however, applies only to the gold, the silver being lost in the operation. It may be possible to evolve a variation that will recover the silver, but no work has yet been done in that direction.

During the course of experimentation an interesting condition was observed. The hydroxylamine hydrochloride alone would precipitate less than 50 per cent of the gold as an amalgam from cyanide solutions even after vigorous boiling with hydrochloric acid to destroy the cyanide before attempting to produce the amalgam. But gold dissolved in aqua regia and treated in the same manner with hydroxylamine hydrochloride could be precipitated as an amalgam with nearly 100 per cent recovery. See Table II for comparative results. From these results it appears that the gold cyanide complex is more stable to the action of hydroxylamine hydrochloride in acid or alkaline solutions than the gold chloride complex, and treating the cyanide solution with hydrochloric acid does not seem to destroy the gold-cyanide complex completely. Because of this behavior it was necessary to precipitate the gold on zinc dust before collecting it in an amalgam.

The proportions of reagents given in the procedure here detailed seem to give the best results, with little or no flocculent precipitate appearing and a good globule of mercury. Variation in the amount of zinc dust added affects the assay to some extent. Too small an amount results in incomplete precipitation of the gold and excessive amounts increase the amount of flocculent precipitate present. It is important to destroy this precipitate by repeating the treatment with ammonium hydroxide and hydroxylamine hydrochloride; also the final parting with concentrated nitric acid is necessary to remove the last traces of mercury and zinc. Incomplete parting is indicated by a gray or black sponge after annealing.

The method of assaying cyanide solutions for gold here described can be used in the field or small mill where very little assaying equipment is available. Light portable equipment would suffice and with some slight variation the method could be applied to hand samples.

One very important precaution must be observed: If a hood with a good draft is not available, the assay must be performed outdoors or in a well-ventilated room, particularly that part of the procedure where the cyanide solution is acidified and boiled. This step produces hydrocyanic acid gas, which is very poisonous if inhaled.

Table I—Results Obtained With Two Methods

Test No.	Mg. of Gold in 25 c.c. Solution: Lead Acetate Method	Mg. of Gold in 25 c.c. Solution: Proposed Method
1	0.214	0.21
		0.22
		0.22
2	0.641	0.67
		0.68
		0.68
3	0.641	0.67
		0.66
		0.67
4	0.708	0.75
5	0.025	0.03

Table II—Results Obtained on Gold Dissolved by Cyanide Solution and Aqua Regia, Respectively

Mg. of Gold in Solution	Mg. of Gold Recovered: From Gold Cyanide Complex	Mg. of Gold Recovered: From Gold Chloride Complex
0.49	0.24	
0.708	0.20	
2.93		2.82
3.78		3.70
3.34		3.28
10.49		10.12

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Chrome Ore in Oregon

THE principal chromite deposits of Grant County, Oregon, occur in belts of peridotite and dunite, largely altered to serpentine, in the Strawberry Range, according to a preliminary report in United States Geological Survey Bulletin 922-D. A few deposits have been found in the Greenhorn Mountains. The most productive mines are east of Canyon City in comparatively fresh unsheared ultramafic rocks in which the original mineralogic and textural characters are well preserved. The borders of the mass are pyroxenitic, and the chrome deposits occur as irregular lenses in the less pyroxenitic and more dunitic central portion. The chromite appears to be genetically related to dunite and is probably of early magmatic origin. Most of the readily accessible deposits of high-grade chromite have been worked out, and future production will be predominantly from low-grade concentrating ore containing from 15 to 30 per cent of chromic oxide (Cr_2O_3). The known reserve in the explored deposits is about 80,000 tons of ore averaging between 20 and 35 per cent of chromic oxide. With sufficiently high prices, probably 200,000 tons of concentrating ore averaging between 20 and 25 per cent of chromic oxide could be mined from the explored deposits in Grant County.

Occurrence of chromite in the Strawberry Range was mentioned by Lindgren in 1901. Mining of chrome ore began in 1916 under the stimulus of high war-time prices, and shipments of 225 tons were made in January, 1917. Total shipments amounted to 3,700 tons in 1917 and 13,600 tons in 1918. Mining ceased when the war ended, and little ore was shipped thereafter. In 1939 about 100 tons were shipped from the Dry Camp mine for testing.

PHOSPHATE

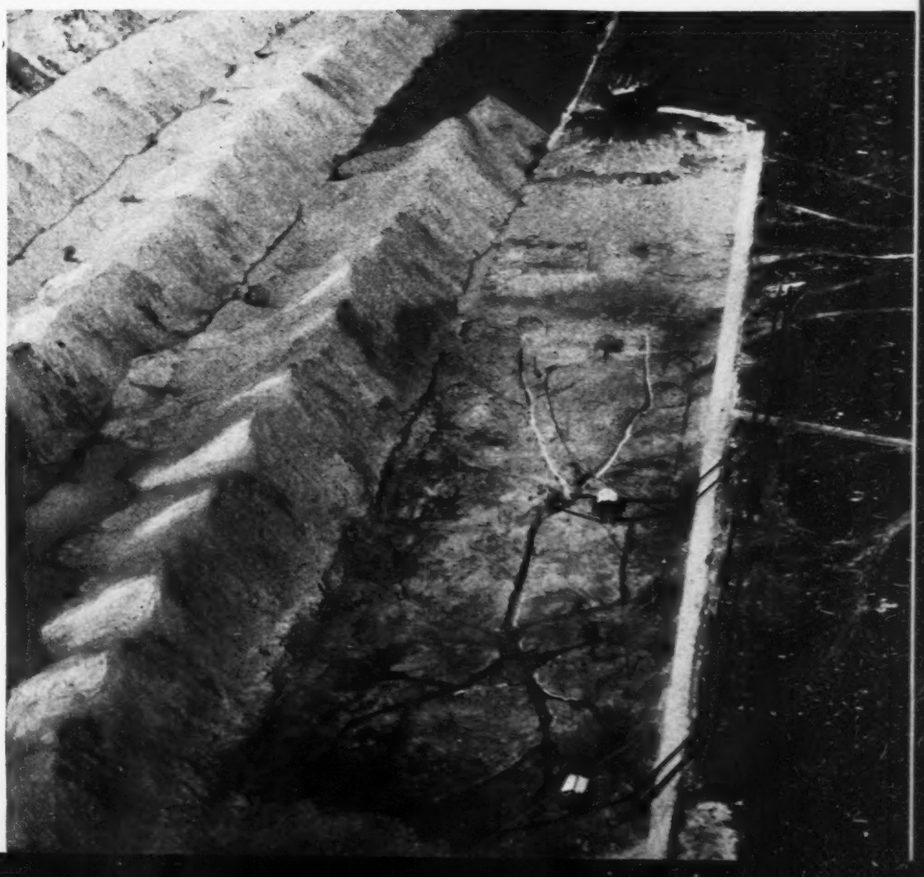
The Vital Non-Metallic

III—Further notes on the mining and washing activities in the Florida pebble field—

The operations of the American Agricultural Chemical Company

A. H. Hubbell
Associate Editor

The town of Pierce, headquarters in the Florida pebble field of American Agricultural Chemical Company, seen from the air. In center background is the company's central dryer, with part of the wet storage piles behind it and the dry storage bins to the right. To the left is the power plant. Photo by Aero-Graphic Corporation supplied by A. A. C. Company



Aerial view of A. A. C.'s Carmichael high-grade phosphate mine. In a cut 225 ft. wide, 25 ft. of overburden overlying the matrix is being removed by the dragline at the rate of 600 cu. yd. per hour and piled in adjacent mined-out cut. The view illustrates the method employed in hydraulicking the matrix. Ditches, pit cars, and water and matrix lines both in the pit and on the bank are well shown. Photo by Aero-Graphic Corporation

▶ IN PARTS I AND II *of this travelogue, published in September and October, respectively, a picture of the operations of three of the seven phosphate producers of the Florida pebble field was presented against the background furnished by the general situation in this industry. In the following paragraphs the story is continued.*

AT PIERCE are the Florida headquarters of the American Agricultural Chemical Company. Besides engaging in extensive fertilizer and chemical manufacturing activities, with plants in many States, as does the International Agricultural Corporation, dealt with in the September issue, this company ranks among the foremost as a producer of phosphate rock and heads the list of operators in respect to the size of holdings in the pebble field. These are placed at 52,000 acres.

Point has already been made of the

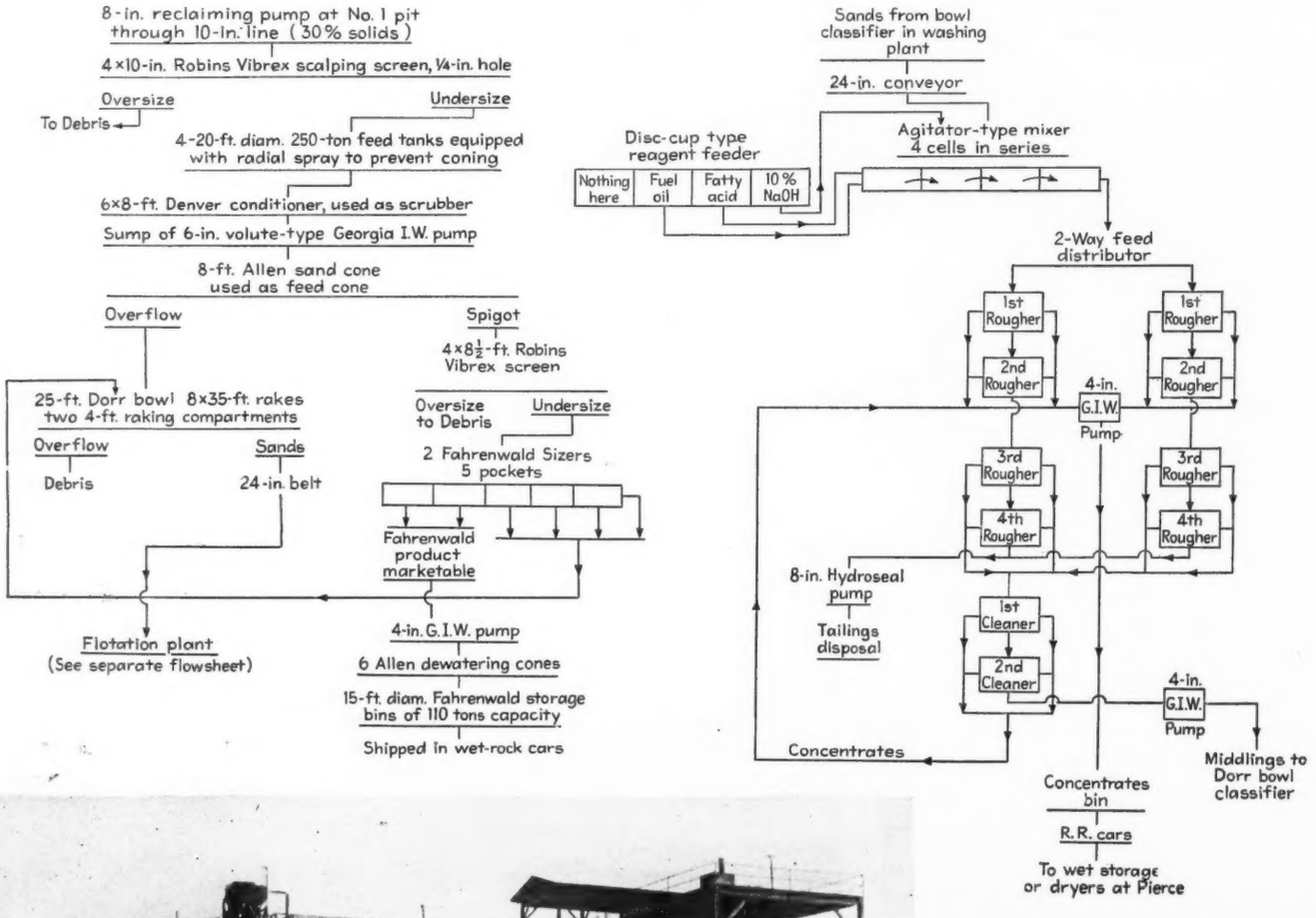
fact that the Florida farmer is the principal owner of phosphate lands in his State. The operating companies naturally do not burden themselves with excessive holdings, if only because of the unnecessary additional taxation this would impose. At the same time, to acquire a particular piece of ground that may be needed, a company may have to take unwanted land, on the principle of "all or nothing." In any case the holdings of these companies appear to be no larger than desirable for a business that may be expected to continue indefinitely and which must be conducted on a large scale to keep its costs down. As one official stated, moreover, a company must have room to turn around in, as well as for waste disposal and settling ponds. The idle lands are often leased to cattle men, after being cut over, at 10 or 15¢ per acre per year, and on sale may bring probably only a trifling sum per acre.

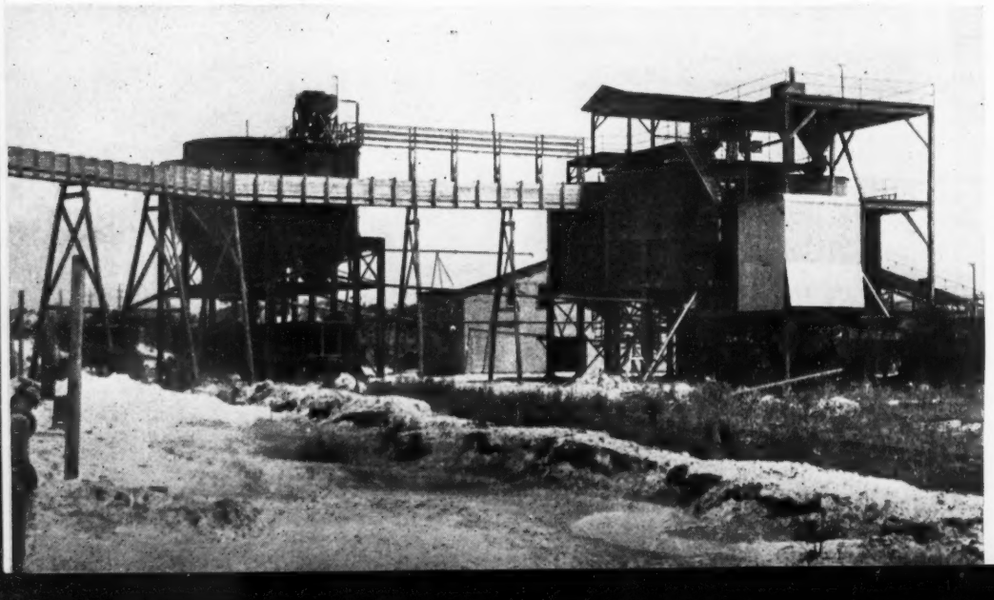
The reserves of the A.A.C. are placed by the company itself at a round 100,000,000 tons, enough to supply it for years at its current rate of output. In this district, the idea of permanency is conveyed by the type of construction and the equipment seen, as well as by the established communities of the area. Nowhere is this suggestion stronger than at Pierce, the "thriving little phosphate city," as the A.A.C. calls it, which is owned and managed by the company.

The company employs approximately 400 men. It has two washers, known as No. 2 and No. 10, the former handling high-grade (75 per cent B.P.L.) rock, and the latter standard grade. At each the practice differs little from the standard. There are also two flotation plants, one on an old mined-out tract, No. 1, where waste is being reclaimed, and the other, at No. 2, handling current waste. Here the terminology of the southeastern phosphate areas merits some attention. A washer discharges to a débris dam or settling area, as it is known. The waste is not called "tailings," this term being used for the reject of a flotation plant, which is stored separately, on the assumption that it is not to be reworked.

H. L. Hudson is manager for the American Agricultural Chemical Company in this field. He took care of me when I called, and made arrangements for me to tour their operations with him the following day.

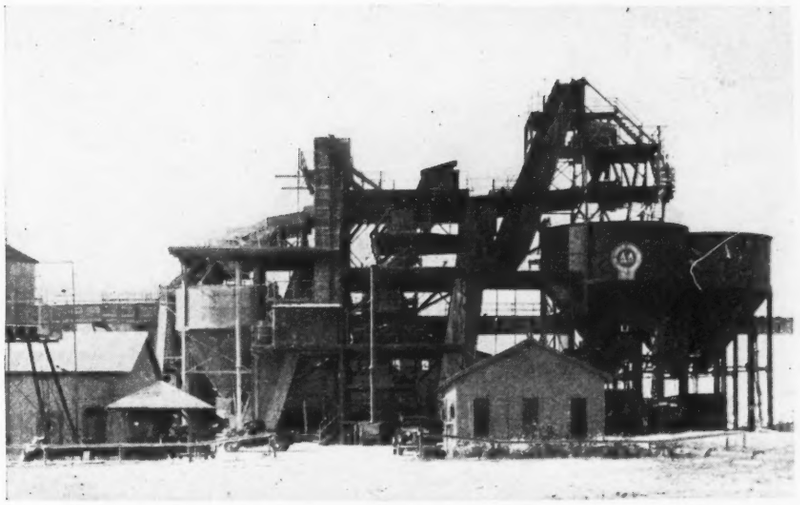
The next morning we went first to No. 10 washer, at South Pierce, 9 miles south of Pierce. Here a large tract is being worked, with dragline stripping and hydraulic mining. In general the mining method is the one commonly employed, differences being found in





Figs. 5 and 6 . . . The flowsheet of the washing plant at Carmichael No. 1 and at the right, that of the new flotation plant at this unit

A. C. C.'s new flotation plant at Carmichael No. 1



The No. 2 Carmichael washer and recovery plant

the sequence and size of the so-called cuts.

Washer No. 10 is centrally located on the tract and at this time mining of one of the subdivisions was almost finished. The cuts run east and west and average 220 ft. in width. The dragline was stripping the southernmost and working east. On the corresponding southernmost cut adjacent on the east, which had already been stripped, mining with monitors was in progress.

In this section the overburden averages 25 ft. and the matrix approximately 10 ft. In the cut that was being stripped, the hydraulic line that would serve the guns and the pipe for the matrix were lying on the surface ready to be set down in the pit. The pit car, or matrix-pumping unit, was also awaiting installation, mounted on steel beams to facilitate handling. It is moved by tractor. Incidentally, the tractor is as useful in and around these pits as it is elsewhere, proving a great labor saver. It made its debut in the field about fifteen years ago.

Various devices have been adopted to speed moving from sump to sump as hydraulic mining progresses up the pit, a task that used to take two crews all day and which, in consequence of the improvements mentioned, now requires about 1½ hours. The distance between sumps or wells averages 125 ft. The various lengths of pipe likely to be needed, ranging from 2½ ft. up to 20 ft., are provided on sledges, for both the matrix and hydraulic lines, the sledges being moved as desired by the tractor. These pipe lengths are already provided with welded flanges. On another sledge all kinds of fittings normally used are kept.

Stripping was being done with a Marion electric (variable voltage control) dragline, having a 150-ft. boom and a 9½-cu.yd. (rated) welded Page bucket with manganese teeth. The bucket actually has 277-cu.ft. capacity. Like most other draglines noted in the district, this is of the full-revolving type and mounted on four caterpillars. The crew consists of an operator and an oiler, plus a ground man. The digging cycle gives about one bucket per minute. Life of teeth is variable. The overburden has few boulders, but the coarse sand is abrasive.

Ropes (except boom cables) are all steel-center; that on the hoist is 500 ft. long and 1¼ in. in diameter; on the drag 210 ft. long and 2 in. in diameter. Boom cables are of 1¼ in. diameter and have a hemp center. They are renewed every two years for safety. As used here, they are provided with safety clamps. Average life of hoist cable is 700,000 cu.-yd.; that of the dragline cable 600,000 cu.yd.

Mining was to be started at the cut then being stripped as soon as the giants were finished at the east end. Wherever the dragline happened to be at that time, it would dig into the matrix to provide a face for the giants, which would then work in both directions along the pit, this variation from the standard practice being possible because two working places were available, just then at least, so that one could be mined while the other was being stripped.

At the east end, where mining was under way, three G.I.W. guns were in service. For any given sump, these were operated so that two attacked the matrix at the same time, or else only one dug matrix while the second was engaged in sweeping.

Mining involves breaking down the matrix with the monitors in such a way that it is washed back into an 8- or 10-ft. sump or well, from where it is picked up by the suction of the pit pump. This necessitates construction of a ditch (or ditches) running from the well to a point (or points) near the bank. These ditches are cut by so-called ditchers who drill the holes for shooting along the line wanted, using a 3-ft. iron bar and sledges. A ditch will be the full depth of the sump at that point and come to surface near the bank. Number of holes and amount of powder will depend upon the ground. Charges are small, such as a half stick per hole. All holes are fired at once with ordinary cap and fuse and blasting machine. The ground thus broken along the ditch line is then sluiced back into the well with a 2-in. hose tapped onto the hydraulic line. The particular position or layout of ditches will depend on the local conditions and the procedure developed by the pit foreman and his crew.

In the pit at the east end the sump had usually been placed at about a third of the pit width from the south bank, the main ditch running from it toward the matrix face about parallel with the pit length. One gun worked ahead of the sump on line with the ditch and about 25 or 30 ft. from the face. From this ditch near the sump, another ditch at 45 deg. ran toward the opposite side to service the other gun either when working at the face or when sweeping. Sweeping was done about every 50 ft. On the nearer side of the main ditch, if branch ditches were needed, they were usually made short so as to interfere as little as possible with the work of advancing the pit car and water lines.

As the mining face advanced, pit pump and matrix line were shifted ahead from time to time to a new sump, freshly dug. This was being done approximately every 125 ft. in this pit.

Pressure on the guns was 200 lb. for sweeping and mining. Tips or nozzles averaged about 2 in. If the bank was tough, a smaller one, 1¾ in., could be used. This would give less water in the sump, a factor to be considered, inasmuch as there must be enough to keep the matrix line running to the washer plant from plugging (say 20 per cent solids). Where the bank had little sand and was heavy so that it did not drift or move readily on being sluiced, a 2¼-in. tip could be used, it was said, if the pump would stand it, to give more water.

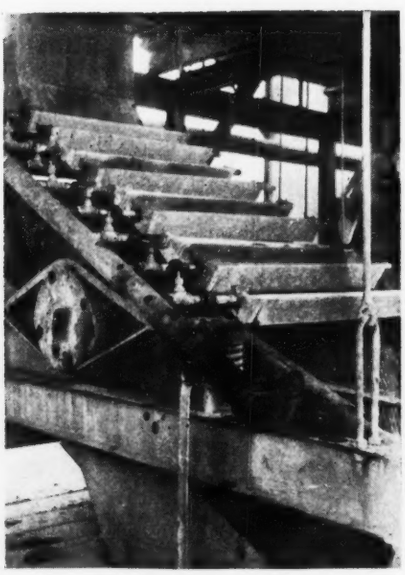
Here the pump discharge line was 14-in. steel casing, on the 12-in. matrix pump. The clear-water (hydraulic) line was of 14-in. casing with welded flanges down to the crowfoot or three-way. From here to the guns it was 10-in. spiral-riveted pipe. The booster pump was a 14-in. Allen-Sherman-Hoff Hydroseal, placed about 1,500 ft. from the pit car at the time and 1,800 ft. in the other direction from the washer. There had been two boosters here.

No. 10 pit crew consisted of 1 mining foreman, 2 gunners, 1 suction tender, 1 motor man, who ran the 300-hp. motor driving the pit pump, and the necessary ditchers and laborers. At the time, operations at this pit were on only one shift per day. Mining could

A general view of A. A. C.'s Carmichael high-grade phosphate-rock washer, showing the recovery plant, the hydraulic station, the water-settling area, and the wet-feed storage

The caterpillar tractor performs many valuable services around a phosphate pit. This one is dragging a sledge loaded with fittings for the hydraulic and matrix lines to speed up the work of moving the hydraulic guns ahead in the pit

One of A. A. C.'s draglines engaged in stripping, photographed from the highway



In the washer at A. A. C.'s No. 10 mine, some of the screens are equipped with sprays of the type seen here. The water overflows the trough

also be done at night, if desired, using a portable 500-watt light (on a 5-ft. stand) with a portable reel of cable. Ordinarily one dragline crew takes care of one mining crew.

A brief stop was made at the hydraulic pumping station serving No. 10. This is equipped with a 2-stage Allis-Chalmers pump, having a 600-hp. motor; a 2-stage A-C pump, driven by a 1,000-hp. motor; and a single-stage A-C pump driven by a 250-hp. motor. At the outset of mining, a deep well was put down, in this case 784 ft. deep. It yields 7,000 g.p.m when run. Subsequently most of the water used is recovered so that only a small amount is required for make-up. The pit takes 3,500 g.p.m., pit seepage accounts for 500 g.p.m., and the washing plant 2,000 g.p.m.

Carmichael was our next point of call. Here is the No. 1 flotation plant, supplied by a pit near by. At the time a 4- to 5-ft. bank of high-grade matrix, running 75 per cent B.P.L., was being worked.

At No. 1 recovery plant, I found C. M. Woodall in charge. This is a new plant, started in February, 1940. Construction was begun in late September last year. It so happened that the site had been cleared just before Germany invaded Poland, at which happening the work was stopped, because of the possible effect of the event on exports. It was renewed, however, two weeks later. Operations at the time were under way during one 8-hour shift. Capacity is said to be 60 tons of dry solids per hour, to supply which the pit had to run approximately 40 per cent of the plant-shift hour. The plant flowsheet is given in Figs. 5 and 6. The following notes will supplement it:

In the flowsheet, Fig. 5, the Dorr bowl classifier that takes the overflow from the Allen sand cone used for feeding is used for desliming, not classification, to get rid of the minus-150-mesh slimes from the feed.

All the débris, consisting of the scalping screen oversize, the bowl overflow, and the oversize from screening the spigot product of the Allen cone, which is so high in iron and alumina as to be unsalable, flows to a sump, from which it is pumped to the waste disposal flume by a 10-in. G.I.W. pump.

In the flotation plant, the machines are the new-type 56-in. sloping-bottom Fagergren cells, each driven through V-belts by a 7½-hp. motor. The largest fraction of the feed is −48 + 150 mesh.

For control purposes a watt-hour meter is hooked up to the first flotation machine. Departure of the line on the chart from the straight indicates that sand is building up. An A.G.E. ammeter on the feed conveyor belt reveals whether or not the load is steady.

Treatment at Carmichael No. 2 washing and recovery plant is said to be different in various respects. It is not described here.

When the matrix treated here contains too much undersize for the flotation plant, the excess is sent for storage to a dam about ¼ mile from the plant. From storage it is reclaimed when the feed runs light, by sluicing it with a monitor to a pump which delivers it to the feed bins of the plant. The flotation concentrate is pumped in a 4-in. line to two 500-ton bins, allowed to drain four to eight hours, and shipped to the dryer situated at Pierce.

The following morning we visited the A.A.C.'s central drying plant at Pierce. This plant has capacity for 50,000 tons wet storage at three points close by, known as *A*, *B* and *C*. At *A* and *C* the cars are dumped from a low trestle with subsequent handling by a Brownhoist crane and grab. Together, *A* and C have three Brownhoists. The track from *A* and *C* runs up on top of wet bins of the dryer. Point *B* wet storage uses a Sauerman tower and a Crescent scraper, immediately next to the dryer. This installation handles only flotation concentrate. The 3-cu.yd. (2½-ton) scraper pulls into the boot of a conveyor, discharging to a shuttle conveyor running over the wet bins. Six such bins, each of 200 tons' capacity, serve twelve furnaces, one to every two. The 18-in. feed belt goes up at fairly steep angle.

The wet bins deliver the feed by a short spring-supported chute having a take-up adjusting screw. A lever operating a switch clears the wet material on the conveyor by about 1 in. If the feed stops, the lever moves and a red signal light flashes on.

Twelve furnaces are installed, all of the Schofield type, formerly made by J. S. Schofield Sons, Macon, Ga. This is an old type, rather common in the district. They were burning Bunker C fuel oil.

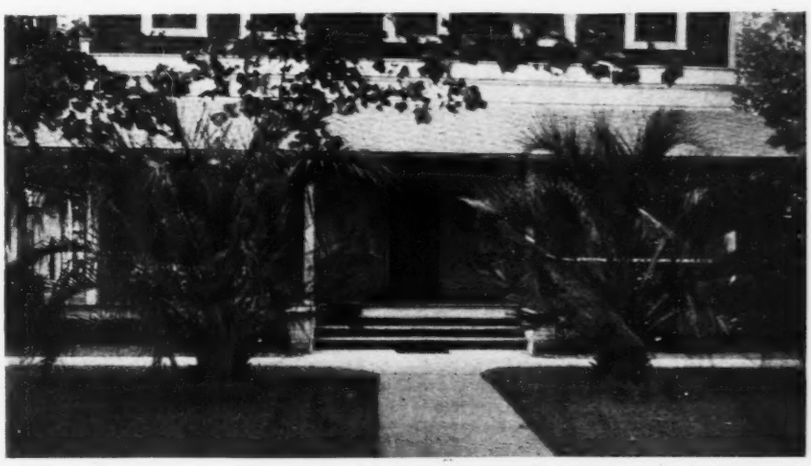
Near the dryer is the company's power plant, with G. E. Kennedy in charge. This twenty-year-old plant has six 600-hp. Edgemore boilers, and makes steam at 200 lb., 500 deg. F., this giving 112 deg. of superheat. Bunker C oil is burned. Two generators are installed: one 6,250-kva. G.E. turbogenerator and one 4,000-kva. Westinghouse. Usually only the first is run. The plant is tied in with the Tampa Electric Company. The turbines are run condensing, the condensate returning to the boilers. Current is made at 2,300 volts at the switchboard and stepped up outside to 33,000 volts to cut the line loss (20 miles of line to Carmichael and 8 miles to South Pierce) and to tie in with the Tampa Electric system. The other phosphate companies for the most part now buy from Tampa Electric.

The chief uses for A.A.C.'s current in its plants are to run the two hydraulic pumps (one 1,000 hp. and one 600 hp.) at South Pierce and two at Carmichael (600 hp. each); also the various pit and booster pumps with 300-hp. motors; and the draglines and washing and recovery plants, with their motors.

A glance at a new fertilizer plant, recently erected by the A.A.C. Company near Pierce, will do no harm. Here a brief stop was made. This plant was started about the middle of February, 1940. It has an adjacent sulphuric acid plant which makes 60 deg. Bé. acid. With this the phosphate rock is treated to produce ordinary superphosphate, the cured product running 18 to 20 per cent available P_2O_5.

For making acid, sulphur is burned in two kiln-type burners, each fed from its own small hand-loaded hopper. At the time one burner was running. The plant comprises lead chambers, and one Glover and one Gay Lussac tower. Mixing of acid and rock is done in a Sturtevant den with a Bradley three-roll mill for grinding the phosphate rock.

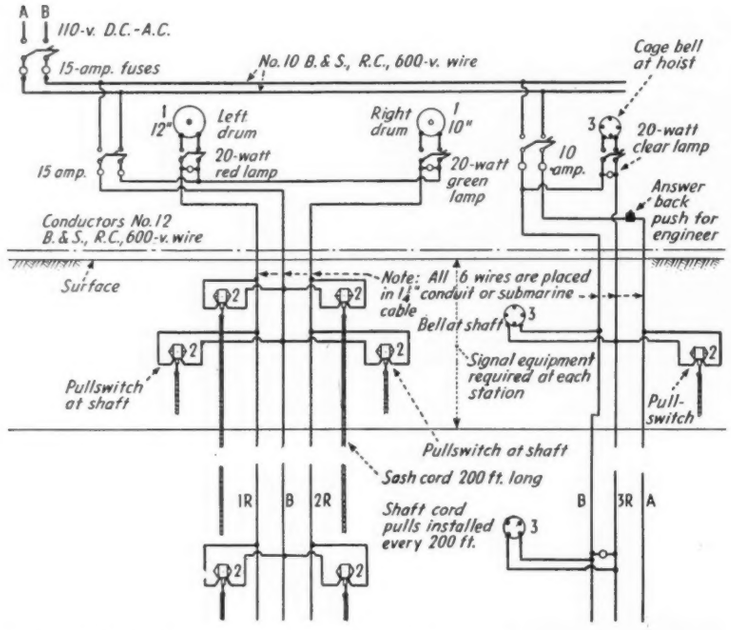
(To be continued)



Office of the A. A. C. at Pierce

USEFUL OPERATING IDEAS

Pull Switches Aid Shaft Signaling



Electric shaft-signaling system. 1, Vibrator bells. 2, Mine-signal pull switches. 3, Heavy-duty, 110-volt mine bells

IN THE shaft-signaling system illustrated in the accompanying drawing, switches operated by rope pulls make it possible to give signals from any point, up or down, in the shaft, according to Paul C. Ziemke, of Milwaukee, Wis. This is of advantage where frequent repairs are necessary or where much chopping of ice has to be done. The system has been found efficient in a 3,500-ft. shaft. Conversion from d.c. to a.c. can readily be done by substituting a.c. bells for those operated by direct current and installing a dry-type, 1-to-1 ratio, 3-kva. transformer in the supply mains, the latter eliminating the grounded phase of the a.c. supply.

The author suggests that all underground splice or pull boxes be rendered dry and free from the baneful effect of moisture by installing in each a carbon-type incandescent lamp. This will furnish both heat and light.

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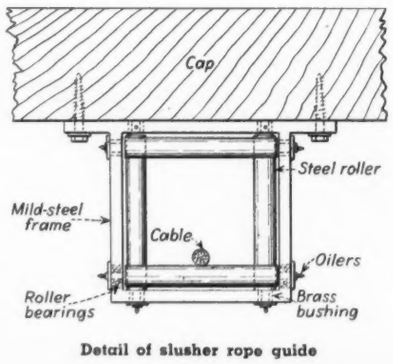
Guide for Slusher Ropes

SUCCESSFUL slushing operations depend to a large extent on the selection of appropriate equipment and its proper installation. This is of particular importance at properties where the work is carried out in long and narrow openings, as in the slushing drifts employed in the modified block-caving method evolved recently at the Emma mine of Consolidated Coppermines Corporation, Kimberly, Nev. Here, an exceptionally large tonnage of ore is handled daily through these drifts, and slushing must be done with as few interruptions as possible to get the desired production into the loading pockets on the haulage level. In the original installations, blocks installed at set intervals and suspended from the caps of the drift sets were used for aligning and guiding the return rope. The practice did not prove satisfactory because frequent interruptions resulted from tangled ropes, and wear on the ropes and blocks made maintenance costs high. These difficulties were overcome after Joseph Gallagher, in charge of maintenance and repair of underground slushing equipment, installed the simple guide shown in the sketch. It is bolted to the cap of the drift set, and consists of a mild-steel, welded frame, and four steel rolls. The lower horizontal roll is fitted with roller bearings, the better to take up the pressure exerted by the fast-moving rope; the remaining three rolls operate in conventional brass bushings. The device can be made at any mine blacksmith shop from scrap material at relatively low cost.



Detail of slusher rope guide

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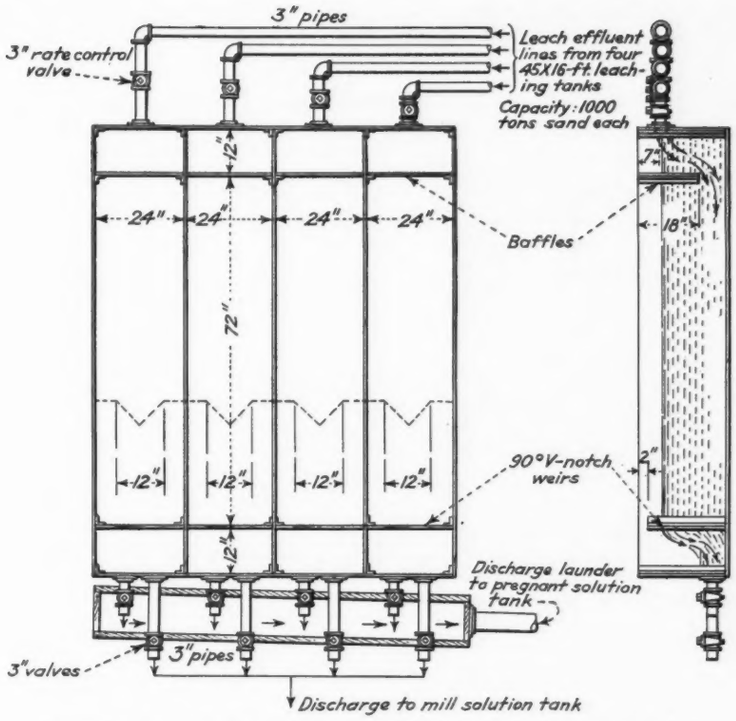
Control Device for Sand-Leaching Plant

CONSTRUCTION and operation of a leaching-plant auxiliary has given excellent service at the 1,000-ton cyanide mill operated by Getchell Mine, Inc., near Golconda, Nev., according to Fred Wise, general superintendent. The accompanying sketch explains it in detail. Here, the equipment installed in the leaching section of the mill consists of four 45x16-ft. steel tanks, each capable of holding 1,000 tons of sand. The device described was developed and installed to provide a central control station to overcome the different handicaps met in ordinary practice. In other words, as operations now can be directed from one central point, the time-consuming job of opening and closing the valves installed at different places on the leach effluent lines has been eliminated and a better control of leaching made possible.

The simple device consists of a rectangular steel tank divided into four separate compartments, each 2 ft. wide, 8 ft. long, and 2 ft. high. At the intake end of each compartment there is installed a steel baffle extending 18 in. into the tank from the top; the discharge end contains a second steel baffle, 22 in. high, with a 90 deg. V-notch weir. These weirs can be



Apparatus for controlling valves of sand-leaching plant from central point

calibrated to give any desired leaching rate.

The flow of leach effluent into the four compartments is controlled by valves on the four lines, and, as will be seen, the solution first enters the narrow section defined by the steel baffle and then flows through the opening below the baffle to the long center section or quiescent zone and over the weir into the short end section, whence discharge lines with valves depending on the character of the solution direct it either to the pregnant solution tank or the mill solution tank. The tank is made from 3/16-in. plate, welded, and all lines and valves are of 3-in. size.

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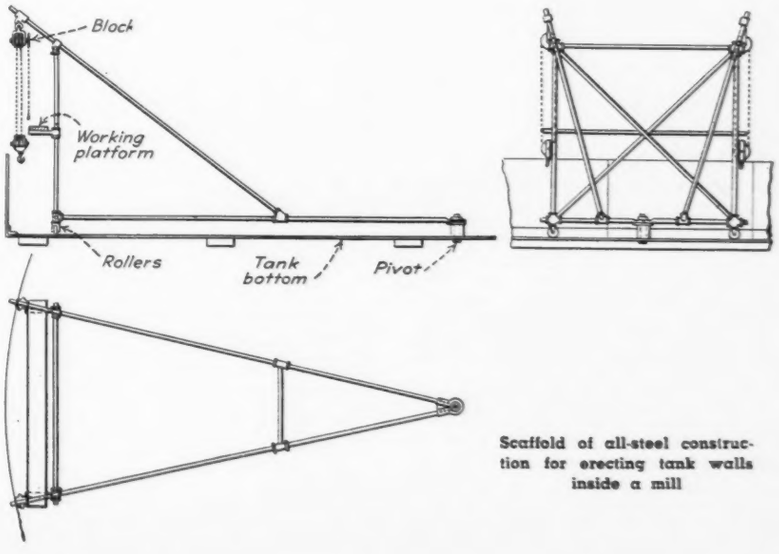
A Handy Scaffold for Mill Work

A CONTRIVANCE that has speeded up the erection of sand-leaching tanks and other tank equipment at the new 400-ton flotation-cyanide mill completed recently by the E. L. Cord interests near Silver Peak, Nev., for treating ore mined in the Cord lease section of the Mary mine, is the novel scaffold illustrated in the accompanying sketch. It is of all-steel construction, some parts being welded, and the revolving feature incorporated in its design facilitates erection of the walls of tanks at a greater speed and with more safety than can be done with conventional methods.

The scaffold consists of an upright section resting on steel rollers, with two braces at the bottom in the shape of a triangle with a welded-on eye-section for the pivot bolt as indicated in the sketch, and two lateral braces extending from about the center of the lower braces to the tops of the columns of the upright section. This latter part also contains a wooden platform resting on short pipes attached to the end column to facilitate erection of the upper part of the tank wall. All lifting is done by two blocks suspended from the extended lateral braces. Operation is simple: The steel sheets are lifted into exact position by the blocks, then bolted, and rivetted, after which the scaffold is rolled to the next location and the operations are repeated. Arthur N. Sweet, general manager, kindly supplied the material presented.

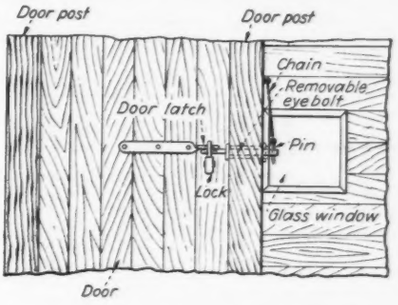


Scaffold of all-steel construction for erecting tank walls inside a mill

▼

Simple Door Lock

TO RENDER prompt aid to injured men the Consolidated Coppermines Corporation maintains a well-equipped underground first-aid station on the main haulage level in its Emma Nevada mine at Kimberly, Nev. The equipment, including several mechanical respirator units, is stored in a large, heated room, which is locked during the absence of



the safety engineer to keep unauthorized persons out. If during such absence a man were brought to the station for treatment and the attendant could not be found immediately, entrance would have to be forced by destroying the lock. Realizing that this was unsatisfactory, James Barbe, safety engineer, installed the lock shown in the sketch. It differs from the conventional lock in that a removable eyebolt is used instead of a stationary one. The door can be opened without destroying the lock by breaking the glass of the small window.

MONTHLY COMMENT • DAILY AND AVERAGE MONTHLY

Summary of the

MARKETS

EXCEPTING LEAD, which heretofore has shown little change pricewise under the stimulation of armament activity, quotations for major non-ferrous metals held a fairly even course during October. Lead advanced one-half cent a pound on heavy buying, but at the higher level a good tonnage of foreign pig lead entered into the domestic market. With copper and zinc under constant surveillance in Washington, the tendency was to maintain the former at 12c., Valley, and the latter at 7.25c., St. Louis. Tin prices moved within narrow limits. Quicksilver was easier. On Nov. 1, the Aluminum Company of America announced that its quotation for the metal would be reduced 1c. to 17c. a pound, effective Nov. 18.

Reflecting higher monthly averages for October, growing largely out of the uplift in prices that occurred during September, the *E. & M. J.* index of non-ferrous metal prices advanced to 82.49 in October, a new high for the year.

Domestic sales of copper during October totaled 125,508 tons, against 254,976 tons in September. Apparent consumption of copper during both September and October averaged more than 100,000 tons a month. Export business in fabricated products, chiefly for the account of Great Britain, has raised consumption to extraordinary heights. Some fabricators found that they had to have some additional supplies of near-by copper and were willing to pay more for the metal than the price at which large mine operators were rationing supplies. As high as 13c. was paid on such business, and the volume influenced our quotations. Many consumers have purchased copper against orders that will not be completed well into next year. The possibility exists that foreign copper will be brought into this country against defense orders, in the event that the supply situation becomes serious.

UNITED STATES MARKET

1940	Electrolytic Copper		Straits Tin	Lead		Zinc
Oct.	Domestic (a) Refinery	Export (b) Refinery	New York	New York	St. Louis	St. Louis
1	11.775	9.850	51.500	5.00	4.85	7.25
2	11.775	9.850	51.375	5.00	4.85	7.25
3	11.775	9.950	51.250	5.00	4.85	7.25
4	11.775	10.000	51.000	5.00	4.85	7.25
5	11.775	10.075	51.000	5.00	4.85	7.25
7	11.775	10.175	51.000	5.00	4.85	7.25
8	11.775	10.200	51.000	5.00	4.85	7.25
9	11.775	10.200	51.375	5.00	4.85	7.25
10	11.775	10.200	51.875	5.25	5.10	7.25
11	11.775	10.425	51.875	5.25	5.10	7.25
12	Holiday	10.425	Holiday	Holiday	Holiday	Holiday
14	11.775	10.200	51.875	5.25	5.10	7.25
15	11.775	10.450	51.875	5.25	5.10	7.25
16	11.775	10.450	51.875	5.50	5.35	7.25
17	11.825	10.600	51.625	5.50	5.35	7.25
18	11.875	10.725	51.625	5.50	5.35	7.25
19	11.775	10.700	51.625	5.50	5.35	7.25
21	12.100	10.950	51.625	5.50	5.35	7.25
22	12.125	10.925	51.500	5.50	5.35	7.25
23	11.875	10.825	51.625	5.50	5.35	7.25
24	11.900	10.825	51.625	5.50	5.35	7.25
25	11.825	10.750	51.500	5.50	5.35	7.25
26	11.775	10.700	51.500	5.50	5.35	7.25
28	11.800	10.725	51.500	5.50	5.35	7.25
29	11.950	10.450	51.500	5.50	5.35	7.25
30	11.775	10.600	51.375	5.50	5.35	7.25
31	11.800	10.550	51.250	5.50	5.35	7.25
			AVERAGES FOR MONTH			
Oct.	11.826	10.436	51.490	5.308	5.158	7.250
			AVERAGES FOR WEEK			
Oct.						
2	11.775	9.850	51.313	5.000	4.850	7.250
9	11.775	10.100	51.104	5.000	4.850	7.250
16	11.775	10.358	51.875	5.300	5.150	7.250
23	11.929	10.788	51.604	5.500	5.350	7.250
30	11.838	10.675	51.500	5.500	5.350	7.250
			CALENDAR WEEK AVERAGES			
Oct.						
5	11.775	9.929	51.271	5.000	4.850	7.250
12	11.775	10.271	51.425	5.100	4.950	7.250
19	11.800	10.521	51.750	5.417	5.267	7.250
26	11.933	10.829	51.563	5.500	5.350	7.250

SILVER, GOLD AND STERLING EXCHANGE

1940	Sterling Exchange		Silver		Gold	
Oct.	"Checks"	"90-day demand"	(c) New York	London	London	(d) United States
1	402.000	(f)	34.750	23.4375	168s	$35.00
2	402.000	(f)	34.750	23.4375	168s	35.00
3	402.000	(f)	34.750	23.4375	168s	35.00
4	402.000	(f)	34.750	23.4375	168s	35.00
5	401.000	(f)	(e)	(e)	(e)	35.00
7	402.000	(f)	34.750	23.4375	168s	35.00
8	402.000	(f)	34.750	23.4375	168s	35.00
9	402.000	(f)	34.750	23.4375	168s	35.00
10	402.000	(f)	34.750	23.3750	168s	35.00
11	402.000	(f)	34.750	23.4375	168s	35.00
12	Holiday	Holiday	(e)	(e)	(e)	Holiday
14	402.000	(f)	34.750	23.4375	168s	35.00
15	402.000	(f)	34.750	23.5000	168s	35.00
16	402.000	(f)	34.750	23.4375	168s	35.00
17	402.000	(f)	34.750	23.4375	168s	35.00
18	402.000	(f)	34.750	23.4375	168s	35.00
19	402.000	(f)	(e)	(e)	(e)	35.00
21	401.000	(f)	34.750	23.4375	168s	35.00
22	401.000	(f)	34.750	23.5000	168s	35.00
23	401.000	(f)	34.750	23.4375	168s	35.00
24	401.000	(f)	34.750	23.5000	168s	35.00
25	402.000	(f)	34.750	23.5000	168s	35.00
26	401.000	(f)	(e)	(e)	(e)	35.00
28	402.000	(f)	34.750	23.4375	168s	35.00
29	402.000	(f)	34.750	23.4375	168s	35.00
30	401.000	(f)	34.750	23.5000	168s	35.00
31	401.000	(f)	34.750	23.5000	.....	35.00
			AVERAGES FOR MONTH			
Oct.	401.692	.....	34.750	23.451	.....	35.00
			AVERAGES FOR WEEK			
Oct.						
2	401.833	.....	34.750	.....	.....	.....
9	401.833	.....	34.750	.....	.....	.....
16	402.000	.....	34.750	.....	.....	.....
23	401.500	.....	34.750	.....	.....	.....
30	401.500	.....	34.750	.....	.....	.....

Calendar week averages, New York Silver: 5th, 34.750; 12th, 34.750; 19th, 34.750; 26th, 34.750.

(e) Not quoted (Saturday). (f) No quotation.

THE above quotations for major non-ferrous metals are our appraisal of the important United States markets, based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis, as noted. All prices are in cents per pound.

(a) Net prices at refineries on Atlantic seaboard. To arrive at the delivered New England basis add 0.225c. per pound, the average differential for freight and delivery charges.

(b) Export prices are net at refineries on the Atlantic seaboard and include sales of domestic copper in the foreign market. Owing to the European War and the disruption of normal trade relations, our export copper quotations, since September, 1939, have been based largely on f.a.s. transactions, ex United States ports. To arrive at the f.o.b. refinery quotations deduct .05 from the f.a.s. basis for lighterage.

Copper, lead and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

Quotations for copper are for the ordinary forms of wirebars and ingot bars; cathodes are sold at a discount of 0.125c.

Quotations for zinc are for ordinary Prime Western brands. Zinc in New York commands a premium over the St. Louis basis equal to the freight differential. Contract prices for High Grade Zinc delivered in the East and Middle West in nearly all instances command a premium of 1c per pound over the current market for Prime Western but not less than 1c over the *Engineering and Mining Journal's* average quotation for Prime Western for the previous month.

Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

(c) Silver other than newly-mined domestic, by Handy & Harman. Under Treasury order of July 6, 1939, the price on domestic newly-mined silver mined subsequent to July 1, 1939, was fixed at 71.11c per troy ounce. Handy & Harman's quotation on newly-mined domestic silver, 999 fine was 70⅝c throughout October.

(d) U. S. Treasury's gold price. Actual payment by the United States Treasury for gold in domestic and imported ore or concentrate is at 99.75 per cent of the price quoted by the Treasury, which at present is equal to $34.9125.

PRICES OF METALS • MISCELLANEOUS QUOTATIONS

LONDON MARKET

1940	Copper			Tin		Lead				Zinc			
	Standard		Electro	Standard		Spot		3 months		Spot		3 months	
Oct.	Spot	3 months	Bid	Spot	3 months	Buyers	Sellers	Buyers	Sellers	Buyers	Sellers	Buyers	Sellers
1	Not quoted			256.0000	260.0000	Not quoted							
2	"	"	"	255.0000	259.0000	"	"	"	"	"	"	"	"
3	"	"	"	255.5000	259.7500	"	"	"	"	"	"	"	"
4	"	"	"	255.7500	260.0000	"	"	"	"	"	"	"	"
7	"	"	"	256.5000	260.2500	"	"	"	"	"	"	"	"
8	"	"	"	257.5000	259.7500	"	"	"	"	"	"	"	"
9	"	"	"	258.5000	260.5000	"	"	"	"	"	"	"	"
10	"	"	"	260.2500	262.0000	"	"	"	"	"	"	"	"
11	"	"	"	259.5000	261.0000	"	"	"	"	"	"	"	"
14	"	"	"	258.7500	260.5000	"	"	"	"	"	"	"	"
15	"	"	"	258.0000	259.0000	"	"	"	"	"	"	"	"
16	"	"	"	257.7500	259.2500	"	"	"	"	"	"	"	"
17	"	"	"	258.2500	259.5000	"	"	"	"	"	"	"	"
18	"	"	"	258.5000	259.7500	"	"	"	"	"	"	"	"
21	"	"	"	257.7500	260.0000	"	"	"	"	"	"	"	"
22	"	"	"	257.2500	260.0000	"	"	"	"	"	"	"	"
23	"	"	"	257.7500	260.2500	"	"	"	"	"	"	"	"
24	"	"	"	258.0000	260.2500	"	"	"	"	"	"	"	"
25	"	"	"	258.7500	261.0000	"	"	"	"	"	"	"	"
28	"	"	"	259.5000	261.2500	"	"	"	"	"	"	"	"
29	"	"	"	259.7500	261.7500	"	"	"	"	"	"	"	"
30	"	"	"	259.2500	261.5000	"	"	"	"	"	"	"	"
31	"	"	"	259.0000	261.2500	"	"	"	"	"	"	"	"
Average for month				257.946									

Prices for tin are the official prices of the London Metal Exchange, in long tons (2240 lb.). Trading in other metals remained suspended.

CURRENT PRICES — MISCELLANEOUS METALS, ORES, AND NON-METALLIC MINERALS

Quotations cover wholesale lots, prompt shipment, f.o.b. New York, unless otherwise stated

(Nov. 1, 1940)

MISCELLANEOUS METALS

Aluminum, ingot, 99 plus per cent, lb	18c.
Antimony, domestic, spot, lb	14.00c.
Bismuth, ton lots, lb	$1.25
Cadmium, commercial sticks, lb	80c.
Calcium, lb., ton lots 97 @ 98 per cent	Nominal
Chromium, 97 per cent grade, lb	89c.
Cobalt, 97 to 99 per cent, per lb	$1.50
Nickel, electrolytic cathodes, lb	35c.
Magnesium, 99.8 per cent, carloads, lb	27c.
Palladium, troy oz	$24.00
Platinum, (Official quotation) troy oz	$36.00
Quicksilver, flask of 76 lb., 100 flasks or more	$168.00
Radium, mg. radium content	$25.00@$30.00
Selenium, 99.5 per cent, lb	$1.75
Silicon, minimum 97 per cent, spot, lb	16.50c.
Tellurium, lb	$1.75
Thallium, 100 lb. or more, lb	$10.00
Titanium, 96 to 98 per cent, lb	$5.00

METALLIC ORES

Beryllium Ore, f.o.b. mines, ton	$30.00@$36.00
Chrome Ore, 48 @ 50% Cr_2O_3 c.i.f. Atl. ports, long ton	(b)$34.00@$36.00
Iron Ore, Lake Superior, Lower Lake ports, long ton:	
Old Range bessemer	$4.75
Mesabi bessemer	$4.60
Old Range non-bessemer	$4.60
Mesabi, non-bessemer	$4.45
Lead (Galena) 80 per cent, Joplin, Mo., ton	$64.54
Manganese Ore, (foreign) c.i.f. U.S. ports, long ton unit of Mn:	
52 @ 55 per cent	(b) 55c.
50 @ 52 per cent	(b) 55c.
46 @ 48 per cent	(b) 48@50c.
Molybdenum Ore, 90%, per lb. of MoS_2, f.o.b. mines	45c.
Tungsten Ore, per unit of WO_3:	
Chinese, 65 per cent, duty paid	$24.50
Domestic, 65 per cent and upward	(a) $23.00
Vanadium Ore, per lb. of contained V_2O_5	27½c.
Zinc Ore, Prime, 60 per cent concentrate, Joplin, Mo.; per ton	$48.00

(a) Prices at mines, small lots, usually several dollars less. (b) Nominal.

METALLIC COMPOUNDS

Arsenious Oxide (arsenic) lb	3½c.
Cobalt Oxide, 70 @ 71 per cent, lb	$1.84
Copper Sulphate, 100 lb	$4.75
Sodium Nitrate, ex vessel, in 200-lb. bags, per 100 lb	$1.42
Sodium Sulphate, bulk ton	$17.00@$18.00

ALLOYS

Beryllium Copper, master alloy, 2.5 to 3 per cent Be, per lb. of contained Be	$15.00
Ferrochrome, 65 @ 70 per cent chromium, 4 @ 6 per cent carbon, lb	11c.
Ferromanganese, 78 @ 82 per cent, gross ton	$120.00
Ferromolybdenum, 55 @ 65 per cent Mo. lb. of Mo. contained	95c.
Ferrosilicon, 50 per cent, gross ton	$74.50
Ferrotungsten, 75 @ 80 per cent, lb. of W contained	$1.90@$2.00

NON-METALLIC MINERALS

Asbestos, f.o.b. mines (U.S. funds), ton:	
Canadian (Quebec)	
Crude No. 1	$700@$750
Crude No. 2	$150@$350
Spinning fibers	$110@$200
Paper stock	$40@$45
Shorts	$13@$17.50
Vermont	
Shingle stock	$57
Paper stock	$40
Cement stock	$25
Barytes, long ton:	
Georgia, crude	$7.00
Missouri, 93 per cent $BaSO_4$, less than 1 per cent iron	$6.00@$6.00
Bauxite, long ton:	
Domestic, chemical, 55 @ 58 per cent	$7.00@$8.05
Domestic, abrasive, 80 @ 84 per cent	$14.00
Dalmatian, 50 @ 55 per cent	Nominal
French, 56 @ 59 per cent	Nominal
China Clay, f.o.b. mines, ton:	
South Carolina and Georgia, No. 1, bulk	$6.75@$8.00
Delaware, No. 1	$14.50
Feldspar, bulk, ton:	
Potash feldspar, 200 mesh	$17.00
Glass-spar, white, 20 mesh	$11.75
Fluorspar, f.o.b. mines, bulk, Kentucky and Illinois 85–5 per cent, all rail movement, ton	$19.00
Fuller's earth, f.o.b. Georgia or Florida, ton	$7.00@$14.00
Magnesite, per ton:	
Dead-burned, f.o.b. California	$25.00
Dead-burned, f.o.b. Washington	$22.00
Mica, per lb., North Carolina, No. 1 and 2 quality:	
1½ x 2 in.	45@60c.
2 x 2 in.	60@80c.
3 x 3 in.	$1.25@$1.50
3 x 4 in.	$1.50@$1.75
3 x 5 in.	$1.75@$2.25
White, ground, 70 mesh, ton	$60.00@$80.00
Ocher, Georgia, ton	$19.00@$22.00
Pyrites, Spanish, per long ton unit of S, c.i.f. Atlantic ports	(a) 12c.
Silica, in bags, 325 mesh, ton	$20.00@$40.00
Sulphur, Texas, mines, long ton	$16.00
Talc, f.o.b. works, ton:	
New York, double air-floated, 325 mesh	$12.00@$15.00
New Jersey, mineral pulp	$8.50@$10.50
Vermont, extra white, 200 mesh	$9.50@$10.00
Tripoli, Missouri, ton:	
40 mesh, cream colored	$14.50
200 mesh, cream colored	$26.00

(a) Nominal

IRON AND STEEL

Pig Iron, Valley furnaces, gross ton:	
Bessemer	$23.50
Basic	$22.50
No. 2 Foundry	$23.00
Steel, base prices, Pittsburgh:	
Billets, gross ton	$34.00
Structural shapes, 100 lb	$2.10
Bars, 100 lb	$2.15

Monthly and Yearly

AVERAGE PRICES

SILVER AND STERLING EXCHANGE

	New York		London Spot		Sterling Exchange	
	1939	1940	1939	1940	1939	1940
January	42.750	34.750	20.305	21.892	466.775	395.442
February	42.750	34.750	20.370	20.935	468.472	395.652
March	42.750	34.750	20.280	20.763	468.370	375.212
April	42.750	34.750	20.031	20.713	467,778	351.817
May	42.750	34.949	20.123	21.878	467.988	326.452
June	41.955	34.825	19.505	22.688	468.137	359.560
July	34.944	34.750	16.952	22.095	468.031	379.750
August	35.951	34.750	17.719	23.261	460.383	396.889
September	36.956	34.750	22.178	23.446	398.820	401.646
October	35.726	34.750	22.736	23.451	400.350	401.692
November	34.750	.....	23.378	.....	391.457	.....
December	34.956	.....	23.263	.....	391.830	.....
Year	39.082	.....	20.570	.....	443.199	.....

New York quotations for silver other than newly-mined domestic, cents per ounce troy, 999 fine, London pence per ounce sterling silver 925 fine. Sterling exchange (pound sterling) in cents.

COPPER

	F.O.B. Refinery, Electrolytic				London Spot			
	Domestic		Export		Standard		(a) Electrolytic	
	1939	1940	1939	1940	1939	1940	1939	1940
January	11.025	11.954	9.912	11.999	43.125	(b)	48.440	(b)
February	11.025	11.148	9.735	11.471	42.188	(b)	47.375	(b)
March	11.025	11.160	9.888	11.407	42.938	(b)	48.120	(b)
April	10.265	11.087	9.820	11.258	42.031	(b)	47.833	(b)
May	9.833	11.079	9.738	11.191	41.656	(b)	47.528	(b)
June	9.775	11.128	9.738	11.216	41.986	(b)	47.528	(b)
July	9.976	10.564	9.944	10.189	42.899	(b)	48.863	(b)
August	10.261	10.708	10.211	9.851	44.685	(b)	50.409	(b)
September	11.635	11.296	11.685	9.849	(b)	(b)	(b)	(b)
October	12.215	11.826	12.491	10.436	(b)	(b)	(b)	(b)
November	12.275	.....	12.929	.....	(b)	.....	(b)	.....
December	12.275	.....	12.631	.....	(b)	.....	(b)	.....
Year	10.965	.....	10.727	.....	(c)42.689	.....	(c)48.262	.....

New York quotations, cents per pound. London, pounds sterling per long ton. (a) Bid quotations. (b) No quotations. (c) Average for eight months.

LEAD

	New York		St. Louis		London			
	1939	1940	1939	1940	1939 Spot	1939 3 mos.	1940 Spot	1940 3 mos.
January	4.826	5.471	4.676	5.321	14.534	14.744	(a)	(a)
February	4.805	5.076	4.655	4.926	14.283	14.417	(a)	(a)
March	4.824	5.192	4.674	5.042	14.660	14.860	(a)	(a)
April	4.782	5.071	4.632	4.921	14.337	14.533	(a)	(a)
May	4.750	5.015	4.600	4.865	14.483	14.679	(a)	(a)
June	4.800	5.000	4.650	4.850	14.564	14.651	(a)	(a)
July	4.854	5.000	4.704	4.850	14.753	14.856	(a)	(a)
August	5.043	4.854	4.893	4.704	16.040	15.885	(a)	(a)
September	5.449	4.929	5.299	4.779	(a)	(a)	(a)	(a)
October	5.500	5.308	5.350	5.158	(a)	(a)	(a)	(a)
November	5.500	.....	5.350	.....	(a)	(a)	.....	.....
December	5.500	.....	5.350	.....	(a)	(a)	.....	.....
Year	5.053	.....	4.903	.....	(b)14.707	(b)14.828	.....	.....

New York and St. Louis quotations, cents per pound. London pounds sterling per long ton. (a) No quotations. (b) Average for eight months.

TIN

	Straits New York		Standard, Spot London	
	1939	1940	1939	1940
January	46.404	46.707	215.435	240.716
February	45.640	45.851	213.906	242.833
March	46.213	47.079	215.375	251.711
April	47.160	46.815	218.389	252.080
May	49.031	51.570	225.591	264.098
June	48.853	54.618	227.511	273.438
July	48.548	51.591	229.833	265.592
August	48.793	51.176	229.869	262.455
September	64.588	50.348	229.292	251.024
October	55.580	51.490	229.943	257.946
November	52.322	.....	230.000	.....
December	50.740	.....	248.974	.....
Year	50.323	.....	226.177	.....

New York quotations, cents per pound. London, pounds sterling per long ton.

ZINC

	St. Louis		London			
	1939	1940	1939 Spot	1939 3 mos.	1940 Spot	1940 3 mos.
January	4.500	5.644	13.682	13.887	(a)	(a)
February	4.500	5.534	13.522	13.780	(a)	(a)
March	4.500	5.750	13.728	13.961	(a)	(a)
April	4.500	5.750	13.443	13.637	(a)	(a)
May	4.500	5.803	13.717	13.938	(a)	(a)
June	4.500	6.235	14.023	14.223	(a)	(a)
July	4.516	6.250	14.235	14.435	(a)	(a)
August	4.719	6.389	14.628	14.761	(a)	(a)
September	6.104	6.920	(a)	(a)	(a)	(a)
October	6.500	7.250	(a)	(a)	(a)	(a)
November	6.500	.....	(a)	(a)	.....	.....
December	5.980	.....	(a)	(a)	.....	.....
Year	5.110	.....	(b)13.872	(b)14.078	.....	.....

St. Louis quotations, Prime Western, cents per pound. London, pound sterling per long ton. (a) No quotations. (b) Average for eight months.

CADMIUM AND ALUMINUM

	Cadmium		Aluminum	
	1939 (a)	1940 (a)	1939	1940
January	58.400	79.038	20.000	20.000
February	55.000	80.000	20.000	20.000
March	54.259	80.000	20.000	19.769
April	50.000	80.000	20.000	19.000
May	50.000	80.000	20.000	19.000
June	50.000	80.000	20.000	19.000
July	50.000	80.000	20.000	19.000
August	53.704	80.000	20.000	18.000
September	64.200	80.000	20.000	18.000
October	74.600	80.000	20.000	18.000
November	75.000	.....	20.000	.....
December	75.000	.....	20.000	.....
Year	59.180	.....	20.000	.....

Aluminum in cents per pound, 99 plus per cent grade. Cadmium, cents per pound. (a) Producers' price, commercial sticks.

ANTIMONY, QUICKSILVER, AND PLATINUM

	Antimony (a) New York		Quicksilver (b) New York		Platinum (c) New York	
	1939	1940	1939	1940	1939	1940
January	11.670	14.000	77.440	156.962	34.440	40.000
February	11.250	14.000	85.227	178.000	35.000	40.000
March	11.269	14.000	87.278	180.921	35.000	40.000
April	11.500	14.000	90.800	173.538	35.000	38.923
May	11.712	14.000	86.769	181.538	35.000	38.000
June	12.000	14.000	86.615	197.360	35.000	38.000
July	12.000	14.000	86.960	194.423	35.000	38.000
August	12.000	14.000	84.407	184.111	35.333	38.000
September	12.910	14.000	140.000	173.333	40.080	36.167
October	14.000	14.000	145.600	168.846	41.120	36.000
November	14.000	.....	134.978	.....	40.000	.....
December	14.000	.....	141.200	.....	40.000	.....
Year	12.359	.....	103.940	.....	36.748	.....

(a) Antimony, cents per pound, ordinary brands, in cases; in bulk 13.415 for October. (b) Quicksilver, dollars per flask of 76 lb. (c) Platinum, dollars per ounce troy.

PIG IRON

	Bessemer		Basic		No. 2 Foundry	
	1939	1940	1939	1940	1939	19400
January	21.50	23.50	20.50	22.50	21.00	23.00
February	21.50	23.50	20.50	22.50	21.00	23.00
March	21.50	23.50	20.50	22.50	21.00	23.00
April	21.50	23.50	20.50	22.50	21.00	23.00
May	21.50	23.50	20.50	22.50	21.00	23.00
June	21.50	23.50	20.50	22.50	21.00	23.00
July	21.50	23.50	20.50	22.50	21.00	23.00
August	21.50	23.50	20.50	22.50	21.00	23.00
September	22.50	23.50	21.50	22.50	22.00	23.00
October	23.50	23.50	22.50	22.50	23.00	23.00
November	23.50	.....	22.50	.....	23.00	.....
December	23.50	.....	22.50	.....	23.00	.....
Year	22.083	.....	21.083	.....	21.583	.....

Iron, dollars per long ton. F.o.b. Mahoning and Chenango Valley furnaces

PERSONAL ITEMS

Eugene H. Dawson has left New York for Canada on a professional trip.

Sydney H. Ball, of the firm of Rogers, Mayer and Ball, is now in the West on a professional trip.

Edward G. Dentzer has been appointed general manager of the Magma Copper Company at Superior, Ariz.

H. L. Roscoe, general manager of Noranda Mines, Ltd., has been elected vice-president of the company.

Gilbert LeBine was recently appointed to the board of governors of the University of Toronto.

T. Platt, inspector of mines and machinery in Victoria, Australia, has been appointed inspector of mines in Tasmania.

Scott Turner became chairman of the Hoover Medal Board of Award of the Four Founder Engineering Societies on Oct. 1.

A. L. Climas has accepted the position of general manager of Marlu Gold Mining Areas, operating in the Gold Coast Colony, West Africa.

J. O. Enberg and **G. H. Newman,** staff engineers of the J. H. Marsman organization, of Manila, lately examined properties in Southern Nevada.

J. C. Davey, until recently with New Goldfields of Venezuela, Ltd., is now underground manager of Compania Francisca de la Mocupia, Ciudad Bolivar, Venezuela.

Rensselaer H. Toll, of Los Angeles, recently completed a professional trip to the La Plata district of southwestern Colorado.

F. F. Colcord, vice-president, United States Smelting, Refining & Mining Company, has been re-elected vice-chairman of The Engineering Foundation, research organization, New York. **A. L. J. Queneau,** metallurgist, United States Steel Corporation, is again a member of the executive committee.

Merle H. Guise, gold placer engineer, after a summer's examinations in Idaho and Montana, has completed work in British Columbia and the Cascades, and has left for California, where he may be reached through St. Francis Hotel, San Francisco.

Colin Yates was recently appointed underground manager of Great Boulder Proprietary Gold Mines, Ltd., Kalgoorlie, in succession to the late R. Beresford Ash.

Dr. H. G. Raggatt, geological surveyor in the New South Wales Department of Mines, has been appointed assistant geological adviser to the Government of the Commonwealth of Australia.

Dr. H. St. J. Summers has been appointed to succeed Professor E. W. Skeats in the chair of geology in the Melbourne University when the latter retires in February, 1941.

Dr. J. B. Tyrrell will receive the honorary degree of LL.D at the fall convocation of Queen's University at Kingston, Ont. Dr. Tyrrell is president of Kirkland Lake Gold Mining Company and has been associated with mining in Canada for more than 50 years.

DR. J. B. TYRRELL

Robert Laurier, nephew of the late Sir Wilfrid Laurier, has assumed the post of Minister of Mines for Ontario, in succession to **Paul Leduc,** who has become clerk of the Supreme Court of Canada.

A. A. Gustafson, engineer in charge of the Nevada office of the Freeport Sulphur Company, has returned to his office in Reno after inspecting rare metal prospects in New Mexico.

D. B. McGilvra, general superintendent Cia Minera Aguilar, Tres Cruces, Argentina, is on a visit to the United States. During his absence **W. B. McPhee** is acting as general superintendent.

Harold Taylour has been elected president of the New Guinea Mining Association. He is general manager of Enterprise of New Guinea Gold and Petroleum Development N. L., Wau, N. G.

H. H. Carroll, general manager of Wiluna Gold Mines, N. L., met with a serious accident recently when he fell down a winze in the mine at Wiluna, Western Australia. He is in hospital in Perth and is reported to be making good progress.

G. F. Kimball, recently at the Powell-Rouyn mine, Quebec, following a stay in Northern Rhodesia, is now with the Royal Canadian Air Force at Military Post 303, Trenton, Ont. He is preparing to instruct air crews going overseas.

N. E. McConnell, recently acting manager at Privateer mine, in the Zebellos area, has been appointed mine manager. A considerable amount of "very high-grade ore" has been discovered, according to **D. S. Tait,** president of the Privateer company.

Robert C. Stanley, chairman of the board and president of International Nickel Company of Canada, Ltd., was recently awarded the Charles F. Rand gold medal for distinguished achievements in mining administration.

Col. Percy E. Barbour arrived in New York Oct. 28 on the S.S. "City of Los Angeles", via the Panama Canal, after having spent the summer in Arizona reopening the Hillside mine. The shaft was sunk to the ninth level and the mill reconditioned and started. Lead concentrates are shipped to El Paso and zinc concentrates to Amarillo.

Dr. C. T. Madigan, lecturer in geology and mineralogy at the University of Adelaide, South Australia, has been appointed to take charge of the field wing of the Army School of Engineering, near Liverpool, New South Wales.

L. E. Fielding has joined the research staff of Electrolytic Zinc Company of Australia, Ltd., at Risdon, Tasmania. He formerly occupied a similar position with the Mount Lyell Mining & Railway Company, Ltd., Queenstown, Tasmania.

H. J. French and **T. N. Armstrong,** metallurgists of the Development and Research Division of the International Nickel Company, Inc., have been awarded the Lincoln Gold Medal for 1940 for their technical paper entitled "Weld Hardening of Carbon and Alloy Steels."

Frank Ayer, general manager of Roan Antelope Copper and Mufulira Copper companies, operating in Northern Rhodesia, Africa, is reported to have left for New York, where he will become consulting engineer for both organizations. He has been succeeded at the properties by **R. M. Peterson,** formerly assistant general manager.

George W. Roddewig returned last month to the United States after having completed a three-year contract as general manager for the Compañia Minera Unificada del Cerro de Potosi, at Potosi, Bolivia. The company is one of the larger producers of tin in Bolivia. For time being Mr. Roddewig's address is 507 N. Palm Drive, Beverly Hills, Calif.

Wendell W. Fertig has been assigned as general superintendent of Samar Mining Company by Elizalde & Company, Inc., general managers. Samar Mining Company is the second largest producer of iron ore in the Philippines, the entire production of high-grade bessemer ore being sent to Japan. Although located

on the east coast of Samar, the address of the company is P. O. Box 119, Tacloban, Leyte.

H. B. Carpenter, vice-president in charge of operations, and **William Gosewisch,** in charge of raw materials, of the Republic Steel Corporation, inspected the Corporation's iron holdings in the Lake Superior District during the week of Oct. 7th.

L. H. Hart has left the geological staff of the Anaconda Copper Mining Company, Butte, Mont., to accept a position with the United States Smelting & Refining Company exploration subsidiary, which has headquarters in Salt Lake City, Utah.

J. W. Reid, superintendent of El Cubo mine, in the State of Guanajuato, Mexico, a property owned by United States interests, who was kidnaped recently, with his wife, and held in $20,000 ransom, was on Oct. 28 reported as having been released.

Frederick T. Kerr has been appointed chief surveyor of New Occidental Gold Mines, N. L., Cobar, N. S. W. Mr. Kerr was formerly chief surveyor at the Central Mine of Sulphide Corporation, Ltd., Broken Hill.

Essington Lewis, chief general manager of the Broken Hill Proprietary Company, Ltd., has been appointed Director-General of Munitions Supply, a full-time position involving his attendance at War Cabinet meetings.

E. M. Lambert and **Lewis Heilig,** of Minneapolis, Minn., instructors at the School of Mines and Metallurgy, University of Minnesota, visited the Mesabi Range recently in connection with iron ore appraisal work for the Minnesota Tax Commission.

J. H. Hearding, Jr., who has been mechanical engineer with the Oliver Iron Mining Company, has been promoted to superintendent of maintenance in the Hibbing-Chisholm district. Mr. Hearding is a son of **John H. Hearding,** now retired but who formerly was general manager of the Oliver company in Duluth.

Dr. J. J. Jakosky has been appointed dean of the school of engineering and architecture and director of the engineering experiment station of the University of Kansas at Lawrence, Kan. Dr. Jakosky has just brought out a book entitled "Exploration Geophysics," printed by the Times-Mirror Press, of Los Angeles, Calif.

B. W. Hills is the author of the article entitled "Dangers of Careless Sampling and Assaying," which appeared on page 38 of the October issue of *Engineering and Mining Journal.* A typographical error caused Mr. Hills's name to appear without the final "s," to the regret of all concerned.

Oscar Lee, who was superintendent of the sintering department of the Ducktown Chemical & Iron Company, Ducktown, Tenn., at the time that company was merged with the Tennessee Copper Company, has assumed charge of the Birmingham iron-ore treatment plant at Bessemer, an operation of the Republic Steel Corporation.

Rex W. Parsons, who has been acting as principal of the Adelaide School of Mines and Industries since the death of F. W. Reid in March last, has been appointed principal. Mr. Parsons, who is a graduate of the School, holds the degree of master of engineering of Adelaide University, and has been instructor in electrical engineering at the School of Mines since 1921.

Captain Kenneth A. Kobe, of the United States Army Chemical Warfare Reserve Corps, and associate professor of chemical engineering at the University of Washington State, is directing research work having for its objective the utilization of vast deposits of manganese-silicate ores existing on Olympic Peninsula, in Washington, by extracting of the strategic mineral from the silica with which it is combined.

Sherwin F. Kelly has formed a company to do geophysical prospecting work in the United States. It is known as the Sherwin F. Kelly Geophysical Services, Inc., of 900 Market St., Wilmington, Del. **Clifford R. Wilfley,** of 1325 Bellaire St., Denver, Colo., will act as Western representative. This company is independent of Geophysical Explorations, Ltd., of Toronto, with which Mr. Kelly has hitherto been associated and which will continue to do work in Canada and other British possessions.

John H. Calbeck, of Joplin, has been appointed director of research of the pigment division of the American Zinc Sales Company at Columbus, Ohio. He formerly was a director of research for the Eagle-Picher Lead Company, and for many years was engaged in private research and consulting work. He has been identified actively with the pigment industry since 1919, following service in France as a first lieutenant in chemical warfare service.

Ray L. Hallows, of Joplin, manager of the Galena smelter of the Eagle-Picher Mining & Smelting Company, has been awarded a patent by the United States Patent Office on a new process used in connection with the refining of lead. The award was made on the basis of fourteen new ideas, embracing two principal phases for the removal of copper from lead as a kettle dross and the recovery of the copper and the lead from the skimmings.

A. J. Martin, of the mineral production and economics division, United States Bureau of Mines, who for several years was connected with the Denver divisional office, has assumed his duties in charge of the Joplin office of the bureau. He succeeded **J. P. Dunlop,** of Joplin, who was in charge of the Joplin office since its establishment in 1928. Dunlop, who had reached the retirement age and was refused an extension period of further service by the Secretary of the Interior, had served 40 years in the statistical branches of the United States Geological Survey and the Bureau of Mines. Martin started with the Bureau at the Tuscaloosa, Ala., experimental station in 1924.

OBITUARY

Alfred F. Beasley, superintendent of Bunker Hill Smelting Company, Kellogg, Idaho, died on Oct. 26 in San Francisco, at the age of 55.

John H. Tresider, of Hibbing, Minn., master mechanic of the Oliver Iron Mining Company in the Hibbing-Chisholm district, died on Sept. 19.

William J. Magladery, long well known in the mining districts of northern Ontario, died recently in Toronto.

Alfred La Rose, discoverer of the famous La Rose mine, at Cobalt, Ont., died last September.

W. E. Craig, Hibbing, Minn., general superintendent for the M. A. Hanna & Company, died suddenly on Oct. 22 in Hibbing.

John Wallace Downie, formerly Minister of Mines and Public Works of Southern Rhodesia, died on Aug. 22 at Salisbury, Southern Rhodesia.

John Edward Clennell, known in the United States and South Africa for his work on the chemistry of cyanidation, died on Aug. 30.

Benjamin McCausland, pioneer mining man of the Southwest and former president of the Chihuahua Mining Company of Mexico, died in Los Angeles on Oct. 3 at the age of 92.

Dr. Frederick Ehrenfeld, head of the department of geology and mineralogy at the University of Pennsylvania and a member of the faculty for 43 years, died on Aug. 16 at the age of 68.

Henry Cort Harold Carpenter (Sir Harold Carpenter), professor of metallurgy at Victoria University and at the Royal School of Mines from 1914 until his death, died near Swanson, England, on Aug. 14 at the age of 65.

S. G. Turrell died suddenly at Mount Morgan, Queensland, on Aug. 27, aged 59 years. Mr. Turrell was technical representative in Australia and the East for North American Cyanimid and associated companies and had occupied that position for the past fifteen years.

Ralph Lathrop Paddock, a retired mining engineer of Katonah, N. Y., died on Oct. 9 at Mount Kisco, N. Y., at the age of 64. Mr. Paddock was a direct descendant of Governor William Bradford of Massachusetts. During the first World War he served as an efficiency engineer for the Government.

Thomas Macmanus, for many years the general representative in Mexico City of the Cananea Consolidated Copper Company, Cananea, Sonora, died at his home in Mexico City Oct. 13. A native of Chihuahua, Mr. Macmanus, who was 61 years old, had lived for long in New York City. He was a graduate of Fordham University and had mined in Mexico for many years.

George Ropes Sheldon, 64, Utah min-

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ing engineer and operator, died Oct. 15 in Salt Lake City. Mr. Sheldon was born at Ishpeming, Mich., Aug. 12, 1867. He graduated from the Michigan College of Mines. He worked as an engineer for the United States Smelting, Refining & Mining Company and the International Smelting & Refining Company.

Edward Church Hutchinson, president of the Kennedy Mining & Milling Company, operating near Jackson, Amador County, Calif., died in San Francisco on Oct. 26 at the age of 78. Mr. Hutchinson had been connected with the company for more than 40 years, first as secretary and then as president and general manager. He was a member of an old pioneer San Francisco family, his father having been James Sloan Hutchinson, an early settler of the West.

Colonel Henry Howell Armstead, a consulting mining engineer and a retired major of engineers in the United States Army, died in Vancouver, B. C. on Oct. 3 at the age of 68. He was the son of Henry H. Armstead, a mining engineer of New York and was an alumnus of the Columbia School of Mines. He was a member of the A.I.M.E., the American Mining Congress, and similar bodies of Canada and South America, and of various military organizations.

Frank W. Bewley, a veteran mill builder and pioneer in many of the Northwestern mining regions of the United States, died on Oct. 1 in Seattle, Wash., at the age of 69. Mr. Bewley had been associated with the construction and operation of mills in numerous mining developments. He supervised the construction of a 1,000-ton cyanide mill at Cold Hill at Virginia City, Nev., in 1920, and built or operated mills in Washington, Idaho, California, Oregon, and Alaska. Mr. Bewley is survived by his widow, three daughters, and two sons. His eldest son, Loyal V. Bewley, is head of the electrical school at Lehigh University.

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LETTERS

The Physics of the Divining Rod

The Editor:

HAVING READ in *Engineering and Mining Journal*, June, 1940, a review of a book called "The Physics of the Divining Rod," written by two members of this Society, I wrote you to the effect that, in my opinion, the review was not a fair one, and suggested that the book might be reviewed again in your columns. You replied that you were not disposed to publish another review, but were kind enough to say that you would publish a criticism of the review if one of the authors or I myself would care to write one. I would therefore be greatly obliged if you would publish the following remarks:

The subject of dowsing is one with which many people have a superficial acquaintance but which, owing to a lack of detailed knowledge, few are qualified to discuss intelligently. Scientists, such as the late Sir Joseph Thomson and Sir William Barrett, who were interested in the subject and who were competent as physicists to investigate its phenomena, unfortunately did not do so; the authors of the book in question, Mr. J. Cecil Maby and Mr. R. Bedford Franklin, are, as far as I know, the first scientists who were both qualified and prepared to undertake this laborious task.

A certain detailed knowledge of a subject is essential for criticism, and this your reviewers do not appear to possess, for using most unparliamentary language, they have classed as "falsehoods" and "half-truths" statements which they are obviously not competent to criticize.

To write a fair review of the book it is essential that the reviewer should be so far acquainted with the phenomena of dowsing as to realize that the initial premises, to which your reviewers take exception, laid down in Chapter IV, are entirely justified by experience.

Your reviewers say that "Very little attention is devoted to psychic or extra-sensory explanations." The authors have not done so because any psychic explanation is incompatible with the phenomena, such as the occurrence of reaction bands, etc., which they are discussing—phenomena which have been observed, but not understood, by others besides themselves.

Your reviewers state that the authors' "peculiar" experiments are not, in general, susceptible of precise repetition. I do not agree. All the essential experiments could be repeated by anyone possessing the necessary sensitiveness, and, I may add, the necessary patience.

Your reviewers appear to take exception to 39 pages of the book being devoted to the theory that cosmic radiation is the primary cause of the movement of the divining rod. Why? Could an unprejudiced reviewer, accepting the honesty of the authors and the genuineness of their experiments, offer any better explanation?

Your reviewers write, "The authors state that unless water is flowing in an underground stream they cannot detect it. This, presumably, implies turbulent flow, as is common in surface streams." The authors make no such statement, nor are they under any delusions as to the nature of the flow of subterranean water. The reviewers should have read the book more carefully.

I note that the review has been published with the approval of the Director, Geological Survey. This is hardly a recommendation. Geologists are not necessarily physicists, and the attitude of the Geological Survey towards dowsing, in so far as it implies water divining, is, to judge from its previous publications on the subject, one of dislike and mistrust, born of ignorance and prejudice.

A. H. BELL
President, British Society of Dowsers
York House, London, W. C. 2

In respect to Mr. Bell's remarks regarding the United States Geological Survey, in the last paragraph of the foregoing letter, the reader should note that the Survey has competent physicists on its staff, as well as geologists, and that the reviewers were evidently considered adequate to the task they undertook.—THE EDITOR.

Some Milling Problems at the Raub Australian Plant

The Editor:

REFERRING to articles on "Some Milling Problems at the Raub Australian Plant," by E. C. Bitzer and C. B. Nines, in your issues of June and July 1940, I wish to inform you that the conditions stated by the authors were those obtaining at the end of October, 1939, the time of their departure, and do not represent current practice, which has since been greatly improved.

The stamp battery capacity is now, and has been for some time, 250 long tons of ore per day, and not 150 to 170 as stated, and when crushing a proportion of soft upper level ore the capacity increases to 300 tons per day. The stamp duty is therefore 3.5 and not 2.5 tons per day, and the stamps operate at 96 drops of 8 in. per minute, with an 18-mesh screen.

The capacity of the ball-mill-classifier unit has, following a rearrangement, been increased to 375 tons per day; and when handling slimy dump tailings, tonnages approaching 450 tons per day are easily maintained.

These capacity increases have been obtained without any additional plant and are the result of alterations effected since the departure of Mr. Bitzer and Mr. Nines. Numerous other modifications, carried out mainly by our present mill manager, Mr. A. J. Bell, have resulted in improved mechanical and metallurgical efficiencies in the other sections of our mill and treatment plant.

WOLFRAM PENSELER, General Manager
The Raub Australian Gold Mining Company, Ltd.
Raub, Pahang, F. M. S.

The Huitzuco Company

The Editor:

IN THE September issue of your paper, we have had the pleasure of reading an article written by Mr. Sidney H. Ball, "Latin America and Our Strategic War Materials."

Kindly note that under the heading of "The Quicksilver Situation," Mr. Ball points out that the Explotadora de Mercurio de Huitzuco, S. A., in the State of Guerrero, is an American company and that due to a long strike, it was taken over by the miners.

Will you be so kind as to take note that the above-named company is a Mexican company and that it is still managed by its directors and the ownership has not passed over to the laborers.

CREDITO MINERO Y MERCANTIL, S. A.
Mexico, D. F.

What Metal Statistics Show

DOMESTIC PRODUCTION of base and other metals needed for the national defense program is being accelerated as much as possible under the prevailing metal prices. Demand for copper both for domestic use and British account is expected to reach well above 100,000 tons per month for some time. Small higher-cost copper producers are unable to contribute their share of future production at the current price of copper at 12c., Valley, and have protested, through the Arizona Small Mine Operators Association, to Leon Henderson, of the National Defense Commission, against the apparent effort of the Commission to freeze the domestic copper price at 12c.

Deliveries of refined copper to domestic consumers during September amounted to 96,485 tons, a new high. Exports of domestic metal were minus 225 tons, the reduction resulting from a revision in totals for prior months. Total disappearance of refined copper for September was below the level attained in August. Stocks of refined were reduced 13,417 tons, the Copper Institute reports, with stocks of blister down 3,827 tons.

Production of blister during September amounted to 79,021 tons, of which 66,622 tons was credited to primary output and 12,399 tons to custom smelters.

The duty-free copper statistics for the first nine months of 1940, follow:

	Production (a) Crude	Refined
January	89,598	80,501
February	76,145	82,761
March	85,796	86,295
April	84,366	80,964
May	82,682	86,029
June	79,845	86,077
July	79,327	99,995
August	(b) 79,967	80,851
September	79,021	82,843
Totals	736,747	757,316

	Deliveries to Customers: Domestic	Export	Totals
January	91,428	13,117	104,545
February	63,215	9,594	72,809
March	64,376	7,517	71,893
April	68,665	2,974	71,639
May	69,467	7,018	76,485
June	61,716	3,439	65,155
July	71,226	3,532	74,758
August	96,383	1,561	97,944
September	96,485	(d) 225	96,260
Totals	682,961	48,527	731,488

	(c) Refined Stocks End of Month
January	135,441
February	145,393
March	159,795
April	169,120
May	178,664
June	199,586
July	215,823
August	198,730
September	185,313

(a) Mine or smelter production or shipments, and custom intake including scrap. (b) Corrected. (c) At refineries, on consignment and in Exchange warehouses, but not including consumers' stocks at their plants or warehouses. (d) Minus, resulting from corrections in prior months.

Available supplies of copper for the last quarter of 1940 exceed consumers' requirements for the same period by 81,000 tons, according to a telegraphic survey completed by the Bureau of Mines, United States Department of the Interior. The canvass indicated that fabricators' requirements for refined copper for domestic and foreign trade were expected to total 361,000 tons during the three-month period, whereas the available supply aggregated 442,000 tons. Of the 64 concerns reporting, 13 indicated shortages. Anticipated requirements of this group totaled 62,100 tons, against an available supply of 49,700 tons. The data include all foreign copper regardless of whether or not it is "duty free," and are thus not strictly comparable with consumption and stock figures released monthly.

Consumer's Position in Refined Copper As of Sept. 30, 1940

(In Short Tons)

	Large Consumers (500 Tons or More) (a)	Small Consumers (Less Than 500 Tons) (a)	Totals
Inquiries sent	26	39	65
Replies received	25	39	64
Consumption:			
September, 1940	194,049	5,580	109,629
Anticipated last quarter of 1940:			
For domestic trade	305,519	17,883	323,402
For export	33,626	4,062	37,688
Totals	339,145	21,945	361,090
Stocks:			
In transit to and at consumers' plants and consumers' stocks at producers' plants:			
June 30	124,652	15,565	140,217
Sept. 30	128,214	17,047	145,261
Other forward purchases as of Sept. 30, for which delivery is certain during last quarter of 1940	281,713	15,099	296,812

(a) Consumption per month.

E & M J Weighted Index of Non-Ferrous Metal Prices

(100 is composite for 1922–3–4)

1929	110.33	1934	69.59
1930	82.87	1935	74.66
1931	60.20	1936	73.45
1932	48.26	1937	90.86
1933	59.79	1938	73.67
		1939	77.71

	1938	1939	1940
January	75.56	77.12	80.85
February	73.43	76.89	77.23
March	72.41	77.09	77.94
April	71.19	74.79	77.19
May	69.15	73.61	77.68
June	67.55	73.17	78.85
July	72.95	71.95	76.72
August	73.94	73.88	76.71
September	74.70	83.07	79.40
October	77.61	84.25	82.49
November	78.36	83.80	....
December	77.13	82.89	....

▶ ZINC — The September and October statistics of the American Zinc Institute, covering all grades, are summarized as follows in tons:

	Sept.	Oct.
Stock at beginning	44,670	30,965
Production	53,119	56,422
Production, daily rate	1,771	1,820
Shipments	(a) 66,824	(b) 64,787
Stock at end	30,965	22,600
Unfilled orders	95,445	116,420

(a) Includes 4,023 tons exported.
(b) Includes 289 tons exported.

Figures on operations of the Prime Western division alone, for the first ten months of the year (January to September revised), in tons, follow:

	Production	Shipments	Stock At End
January	19,930	25,240	24,742
February	22,542	20,017	27,267
March	23,846	20,401	30,712
April	21,742	20,034	32,420
May	21,173	24,292	29,301
June	19,302	23,143	25,460
July	20,698	26,139	20,019
August	21,224	27,774	13,469
September	22,873	28,986	7,356
October	24,166	26,425	5,097

▶ LEAD—The refined-lead statistics for the months of August and September, according to the American Bureau of Metal Statistics, in tons, follow:

	August	Sept.
Stock at beginning	47,360	43,321
Production:		
From domestic ore	36,851	41,528
Foreign and secondary	10,763	9,913
Totals	47,614	51,441
Domestic shipments	51,643	53,456
Stock at end	43,321	41,292

The strike at the Selby lead smelter in California was recently settled.

▶ QUICKSILVER—Following is a summary of the latest report on quicksilver issued by the Bureau of Mines, the figures representing flasks of 76 lb. each:

	Aug.	Sept.
U. S. Production	3,500	3,600
Imports	None	None
Exports	633	799
Consumption	2,100	2,100
Consumers and dealers stocks	12,900	13,100
Producers stocks (a)	720	377

(a) Stocks held by producers reporting to the Bureau of Mines on monthly basis.

The record for the first nine months of 1940 shows that 25,600 flasks were produced in this country; 171 flasks imported for consumption; 18,900 flasks consumed; and 7,931 flasks exported.

Of the 633 flasks exported during August, 397 flasks went to Canada and 167 flasks to the United Kingdom. All exports are now under license. There were no exports to Japan during August.

The Cherokee Mine, near Greenville, Calif., is producing gold-silver ore for treatment in its 250-ton flotation plant, shown above. The flowsheet incorporated the use of a jig between the ball mill and classifier, the product of which is treated in an amalgamation barrel

CALIFORNIA

Lava Cap Corporation Completes Tailings Plant

About 40 tons of concentrates will be treated daily—Quicksilver, tungsten, and lead properties show more activity

▶ According to an announcement received from Otto E. Schiffner, vice-president and general manager, Lava Cap Gold Mining Corporation, third largest gold producer in California and operator of the Banner and Central mines and 400-ton flotation mill near Nevada City, Nevada County, work has been completed on the new tailings-treatment plant, and milling operations were expected to be started around Nov. 15. Equipment contained in the new unit includes a 16-ft. bowl classifier, two 50x12-ft. leaching tanks, one 50x10-ft. leaching tank, and auxiliary machinery. The treatment plant, now handling about 40 tons of concentrates a day and consisting of two 5x10-ft. ball mills, a 12-ft. bowl classifier, 8 Devereux agitators, 6 thickeners, 12x14-ft. and 14x18-ft. drum filters, and necessary solution tanks and precipitation equipment, was started up on Oct. 10. Production at the mines averages 400 tons a day.

▶ Construction of a 40-ton reduction plant is reported to have been started at the Socrates quicksilver mine, at Pine Flat, Sonoma County, purchased recently from Healdsburg interests by H. C. Wilmot, of Sutherlin, Oregon, operator of the Bonanza quicksilver mine near Sutherlin, Oregon.

▶ Dragline dredging operations are in progress on the Schneider ranch, in the Scott River area of Siskiyou County, following transfer and reassembly of equipment formerly working near Weaverville, Trinity County, by Oro Trinity Dredging Company. The digging element and washing plant are capable of handling from 2,500 to 3,000 cu.-yd. of gravel a day, and fifteen men are employed at the dredging site. Charles Cummings is president and general manager.

▶ Production has started at the Mount Jackson quicksilver mine, near Guerneville, Sonoma County, following installation of a 75-ton capacity reduction plant, crushing, and compressor equipment, and surface plant buildings. The property is operated by Sonoma Quicksilver Mines, Inc., H. D. Tudor, president, and twenty men are employed under the direction of S. F. Wickham, superintendent.

▶ Construction of a cyanide unit for treatment of concentrates is in progress at the Scotia property of Golden Center Mining Company at Grass Valley, Nevada County. When completed the plant will be capable of handling about 5 tons of concentrates a day produced by the 150-ton flotation mill adjacent to the Scotia shaft. The company is headed by Cooley Butler, of Los Angeles, and about 120 men are employed.

▶ Sinking operations and general development work are carried on at the property of Golden Acacia Mines, Inc., near Auburn, Placer County, and installation of a small mill is planned. A. P. O. Crabtree is president of the company.

▶ Fairfield Mining & Milling Company, operators of several tungsten properties in the Bodfish-Havilah-Weldon area of Kern County, has enlarged the capacity of the available pilot plant to 75 tons. Company holdings include the King and Prosperity mines, near Havilah, and the Miranda claims at Weldon. George Smith is general manager.

▶ A milling plant of 500 tons' capacity is scheduled to be installed shortly at the property of Lookout Mountain Mining Company, near San Andreas, Calaveras County, where a large body of low-grade has been developed recently by underground and open-pit methods. The company holdings cover the Lookout Mountain, Etna, and Golden Hill mines, and a 50-ton Huntington mill is available at the property. H. P. Hoyt is president, and H. L. Parkman, general manager and treasurer.

▶ The Darwin lead mine, near Darwin, Inyo County, has been optioned by the Imperial Smelting & Refining Company, of Los Angeles, and a crew of men is currently employed in rehabilitating camp buildings, sampling, and development work. H. Kingsbury is in charge.

NEW MEXICO

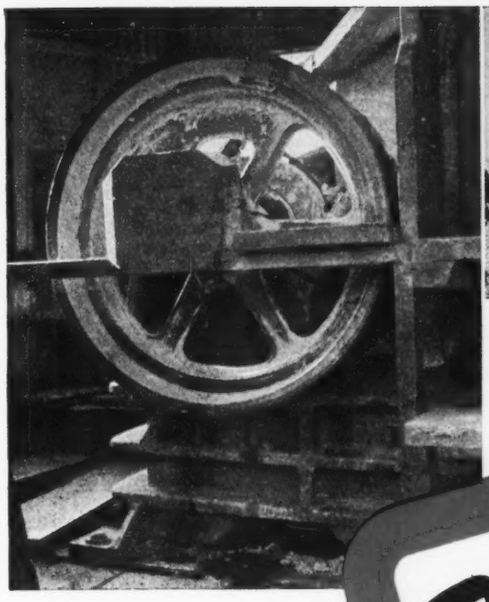
Manganese Production Increasing

Operations become more active as Metals Reserve Company contracts with Newal-Pitt Corporation to produce 180,000 tons

▶ In line with its policy of encouraging domestic production of manganese ore, Metals Reserve Company, an RFC subsidiary, has contracted to take the first 180,000 long tons of manganese ore of the Newal-Pitt Corporation from New Mexico. The purchase will go into the Government stockpile as ore. Neither grade nor price was announced and details of delivery terms also were withheld. The company is reported to maintain offices in Pittsburgh, Pa.

▶ A convention of the New Mexico Miners and Prospectors Association will be held in Albuquerque on Jan. 15, 1941. A. S. Walter, dean of mining and metallurgy, New Mexico School of Mines, Socorro, is president of the association.

Surface plant of the Banner Mining Company at Lordsburg, N. M., where copper, gold, and silver ore is treated in a 350-ton flotation plant. Shrinkage mining is employed and mechanical loaders are used underground



(above) *El Dorado Crystal Mine, Shingle Springs, California, and* (left) *9x30 Telsmith-Wheeling Jaw Crusher handling mine run, reducing it to 1½".*

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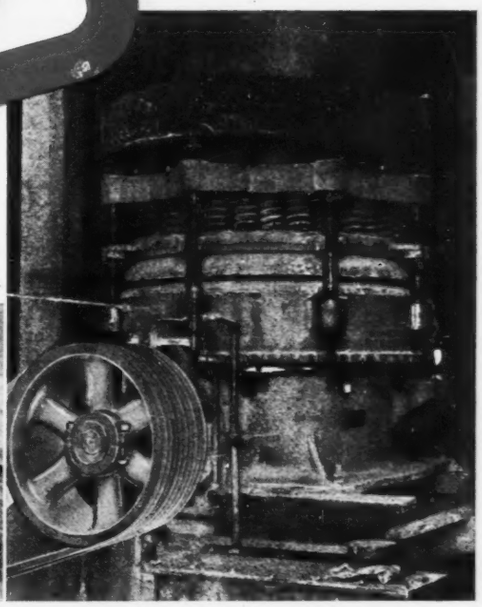

At the Mary Mine, Cord Lease, Silver Peak, Nevada, 18x30 Telsmith-Wheeling Jaw Crusher paired with 36" Telsmith Gyrasphere (right) *produces minus ¾" feed for ball mills.*

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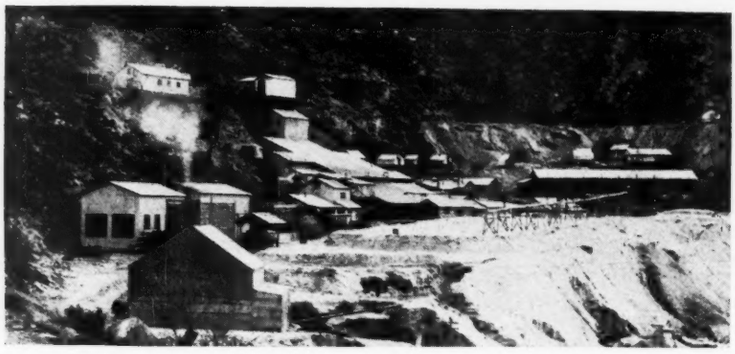

Operations of the Hillside Mines, Inc., near Bagdad, Ariz., consist principally of an extensive campaign developing the zinc-lead deposit that also contains some gold and silver

ARIZONA

Copper Miners Get Wage Boost

Higher price for metal affects daily wage of several thousand workers—Red Rover gold-silver mine treating ore in new flotation plant

▶ A wage increase approximating 5 per cent became effective on Oct. 7 for several thousand copper miners throughout the State. Under terms of an agreement basing daily wages on the sliding scale of copper prices, Phelps Dodge Corporation, the largest copper producer in the State, announced that the 11½c. price having been effective for 30 days, wages were increased accordingly. Increases were also made at other copper mines in the State.

▶ A new 100-ton Fahrenwald flotation plant has been added to the milling facilities at the Red Rover gold-silver mine north of Cave Creek. An orebody 40 ft. wide and over 200 ft. long has been opened on the 500 ft. level. Present production is about 50 tons daily and five cars of concentrates are being shipped monthly to the smelter. Ira Wagnon, of Cave Creek, is superintendent.

▶ Keene St. Charles, owner of the Golden Door mine, in the Weaver district northwest of Chloride, Mohave County, reports the leasing of the property for examination to John O. Greenan, 206 North Virginia St., Reno, Nev. For the past two years the property has been under lease to the Imperial Gold Mines Company.

▶ The Gold Cliff Central Mining Company's mill, at Little Golconda, recently started production of concentrates on ores from the Little Jimmie claim of the Little Golconda group. The company is conducting an examination of the old Towne mine, near Chloride. R. E. Tabor, of Los Angeles, is president of the Gold Cliff Central Mining Company and E. M. Leonard, of Kingman, is in charge of operations.

▶ A 4-ft. vein carrying excellent gold and silver ore has been opened on the Horn Silver property, 10 miles northwest of Chloride near the Pope mine. Ore is now being shipped to the mill of the Producers, Inc., at the old Pilgrim property. The vein was narrow at the surface, but at a depth of 100 ft. it had widened to 4 ft. A crosscut is also being driven to cut a parallel vein which shows good values at the surface. C. M. Richardson, A. M. Bell, and M. H. Buchanan are operating the property under lease.

▶ C. H. Butler, of the Micro-Cell Insulation Company, has completed a screening plant at the company's property 12 miles southeast of Kingman for the production of vermiculite, a nonmetallic used as an insulation material in construction. A cleaning plant will be built soon at Louise, two miles east of Kingman. Mr. Butler's address is 2319 Norwalk Ave., Eagle Rock, California. He also receives mail at Kingman.

▶ A 100-ton mill has been contracted for by the Polaris Mining Company of Clifton. A 40-ton shipment of ore is said to have given returns of $52.60 per ton, principally in gold. The group consists of 41 claims owned by J. A. Hagen, of Clifton. J. W. Buckley is president of the Polaris Company. His address is Box 871, Clifton, Ariz.

▶ Arical Mines, Inc., of Prescott, commenced operations recently on the Cilker and Lawson placers in the Big Bug district near Mayer. A floating washing plant is supplied with gravel by a dragline. E. R. Mattison, formerly with the Lynx Creek Placer Mining Company, is superintendent.

▶ A diamond-drilling program under the direction of J. T. Matson, 56 Sena Plaza, Santa Fe, N. M., is under way, at the Republic copper mine near Dragoon.

▶ Recent developments in the Manganese and Silver Hill properties owned by the Victor Consolidated Mining Company 25 miles south of Tucson has disclosed some high-grade silver-copper ore. A 25-hp. hoist is being erected and complete mining equipment installed. R. J. Monahan, of Tucson, is president.

▶ The Ahlburg Exploration Company, Frank Ahlburg, president, 312 South Commonwealth Ave., Los Angeles, Calif., has installed a 75-ton concentrator at the Paymaster lead, silver, and copper mine at Olive Camp 25 miles south of Tucson. W. F. Lawson, of Tucson, is owner of the mine.

▶ About 20,000 tons of ore reported to average 18 per cent zinc, 3 per cent copper, and 3 oz. silver, have been blocked out in the Contention mine, 25 miles south of Tucson. William F. Foy, Box 8, Ruby Star Route, Tucson, is owner of the property.

▶ The Big Bug Dredging Company is conducting a placer operation on Big Bug Creek about 6 miles from Mayer, with a floating dredge capable of handling 3,000 cu.yd. of gravel daily. C. S. Barnes, of 13424 Gatewood, Van Nuys, Calif., is in charge of operations.

▶ The flotation mill at the Golden Turkey Mines, Inc., at Cordes, is treating around 75 tons of silver ore daily, that also contains lead-zinc. Concentrates are shipped to the El Paso smelter. Sinking continues beyond the 1,800-ft. level and drifts are being developed on the 1,200-ft. level. The shaft follows the dip of the vein at about 20 deg. and ore is hoisted in mine cars. About 80 men are employed. H. C. Mitchell, of Cordes, is vice-president and general manager.

▶ The Scribner mines, in the Swisshelm district, 17 miles east of Elfrida, has discovered a new orebody after driving a 435-ft. crosscut cutting the vein. The mine is now producing from 10 to 12 tons of ore daily having a value of $15 to $20 a ton in lead and silver. Arthur Haynie is leasing the property and in charge of the operations.

Tin Smelter Plans Being Studied

PROVIDING tin-smelting capacity in the United States has been one of the most difficult metal jobs on which the National Defense Commission has worked. Eight formal proposals and many informal suggestions were referred to a special tin advisory committee made up of Clyde Williams, director of Battelle Memorial Institute, Columbus, Ohio, as chairman, and Walter C. Smith, Cerro de Pasco Copper Corporation, John F. Thompson, International Nickel Company, and F. W. Willard, Nassau Smelting & Refining Company, all of New York City.

During the latter part of October this committee held a number of sessions in Washington with a first responsibility for recommending a smelter plan which would provide capacity for handling the Bolivian ore already under contract for Metals Reserve Company. The tentative first decision of the Defense group was to use about $3,000,000 of R.F.C. money to build a smelter capable of handling 60,000 tons of concentrate per year.

One of the most difficult questions involved in the tin case is a political one, namely, what district of the country would get the smelter. All R.F.C. and Defense officers agree that the decision should be based on the economy of production combined with suitability of smelter location from the standpoint of expected metal use.

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NEWS FROM Washington

By Special Correspondent

PLANNING for four million men under arms is going to be the next big job for Washington. This will create new and more difficult tasks for the mining industry. Supply of metals and minerals for a defense program contemplating two million soldiers was comparatively easy. In manufacturing, transportation, and mining there were reserves of capacity without new construction to satisfy the smaller defense program. But these reserves are not nearly enough for a four million-man plan in many cases.

Recognizing this situation, the basis has been laid during October for a priority plan for later enforcement. Under it there will be arrangements for the assignment of limited supplies where they will do the most for the defense program. Washington hopes that few arbitrary or extensive orders will be needed. The plan for voluntary rationing and allocation of limited supplies will be followed as long as possible.

But official orders may become necessary, possibly within the near future for some commodities.

Tin-Ore Purchase

THE GOVERNMENT is buying tin concentrates from Bolivia under a contract of Metals Reserve Company, the R.F.C. subsidiary, with a group of Bolivian mining companies. The contract provides definitely for concentrates containing 12,000 tons of refined tin per year, with a contingent proviso for an additional 6,000 tons if this extra supply is not required for British contracts. Hochschild interests will provide 850 tons, Aramayo, 300 tons, and the Bolivian Government's Banco Minero, together with Asociacion Industriales Medianos, the remainder of the 1,500 tons per month planned under the total contract. It is provided that the amounts here specified may later be increased.

The Patiño interests did not participate in the agreement. It was explained in Washington that the entire production of that group, 14,000 tons per year, was previously committed to the British Government and could not be diverted to the United States.

The contract is for five years. The price of the concentrates, with allowance for freight and normal treatment and smelting charges equal to those of the British smelters, will make the tin cost 48.5c. per pound when ready for the first stockpile. Government officials expect that actual smelting cost in the United States will be somewhat greater than the English smelting charges. They, therefore, estimate the cost of the refined tin in stock will be slightly over 50c. per pound.

This contract was closed and announced on Oct. 19 by R.F.C. negotiators without regard to the final plans then under consideration for a tin smelter to be built in the United States.

Strategic Tax Exemption

IN THE EXCESS-PROFITS TAX LAW, which took effect when signed by the President Oct. 8, there is an exemption from excess-profit taxes for corporations engaged in mining of certain strategic metals. The following is the significant paragraph: "In the case of any domestic corporation engaged in the mining of tungsten, quicksilver, manganese, platinum, antimony, chromite, or tin, the portion of the adjusted excess profits net income attributable to such mining in the United States shall be exempt from the tax imposed by this subchapter. The tax on the remaining portion of such adjusted excess profits net income shall be an amount which bears the same ratio to the tax computed without regard to this section as such remaining portion bears to the entire adjusted excess profits net income."

The selection of metals and minerals in this law was made to provide protection against new taxes for those firms thought likely to become engaged in special strategic mineral development soon. Three mineral commodities on the strategic list of the Army and Navy were not included, namely, nickel, mica, and quartz crystal. Platium is the only one of the metals that was included which is on the critical-materials list, not on the strategic list.

Overtime Wage Rules

MANY WHITE-COLLAR WORKERS paid $200 per month or more are now exempt from the 44-hour week under the new definitions of executive, administrative, and professional employees. These new exemptions are being widely complimented by business executives who would otherwise have encountered serious difficulties in some cases now that 40 hours is the maximum week permissible without overtime payments. (since Oct. 24).

Effort is being made by the Wage and Hour Division to cooperate with firms engaged in employee training. It is now provided that such activities are not included within the definition of "working time" if the worker voluntarily takes up the training and the program is given outside regular working hours. It is necessary, however, that the training establish a definite new or different skill for the worker so that he is eligible for higher or different positions. The actual production of goods during such training program is not permitted.

Many fundamental questions as to the meaning of the Fair Labor Standards Act will come before the Supreme Court for review in pending cases for which decisions are expected during the term opened in October.

Manganese Conservation

MILITARY and civilian effort of Washington with respect to manganese is now being directed largely toward means by which the consumption of that important strategic material can be reduced. At present, this effort is purely investigation of possibilities. No restrictions have been imposed, nor are any contemplated for the immediate future.

The committee of technologic advisers with respect to manganese reported various possibilities for saving of this metal in a memorandum to the Defense Commission. Many of the important manganese users have been asked to review these suggested possibilities. It is hoped that the forward-looking recommendations may get serious consideration and, to some extent, immediate action. The present relatively high price of manganese, of course, will encourage this. The Defense officials are hoping that some substantial savings can be made promptly. And they hope that those who achieve some improved metallurgic practice saving manganese will share their advances with other companies, all for the general good of the industry.

No quantitative estimates have been announced as to possibilities expected or hoped for. But the saving does amount to a very substantial percentage

Consumption of Tin in United States, 1938-39, by Finished Products (tin content), in Long Tons

(Bureau of Mines)

	1938			1939		
	Primary	Secondary	Total	Primary	Secondary	Total
Tin-plate	(a)23,545	...	23,545	(a)36,640	...	36,640
Terneplate	264	(b)743	1,007	317	(b)1,137	1,454
Solder	7,590	5,298	12,798	9,578	7,701	17,279
Babbitt	2,893	1,264	4,157	3,850	1,598	5,448
Bronze and brass	2,334	1,598	3,932	3,385	3,051	6,436
Collapsible tubes	3,427	...	3,427	3,507	(c)	3,507
Tinning	1,738	35	1,773	2,165	172	2,337
Foil	(d)2,283	(c)	(d)2,283	2,001	(c)	2,001
Chemical (other than in oxide)	166	910	1,076	167	288	455
Pipe and tubing	948	(c)	948	606	(c)	606
Tin oxide	547	444	991	651	359	1,010
Type metal	134	978	1,112	149	990	1,139
Galvanizing	792	...	792	1,028	...	1,028
Bar tin	456	213	669	1,100	241	1,341
Miscellaneous alloys	238	19	257	404	45	449
White metal	390	44	434	466	42	508
Miscellaneous	371	(d)202	573	569	221	790
Totals	(d)48,116	(d)11,658	(d)59,774	66,583	15,845	82,428

(a) Includes small tonnage secondary pig tin. (b) Tin content of terneplate. (c) Small quantity reported included under miscellaneous. (d) Revised.

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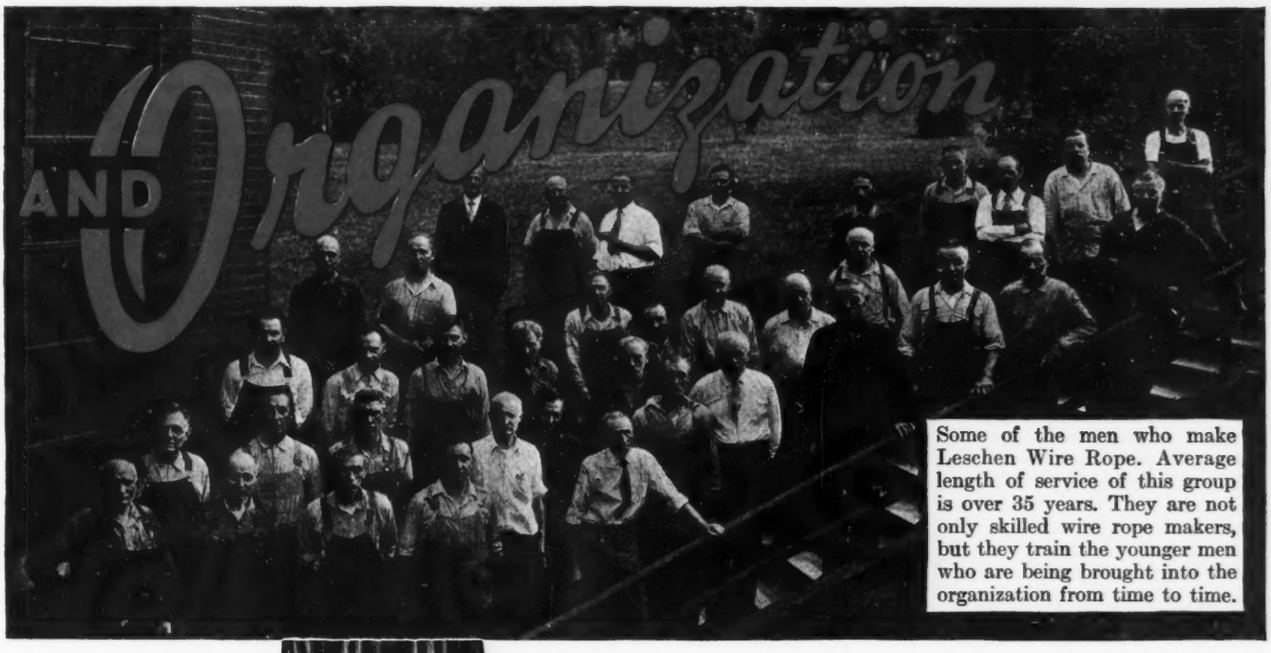

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of the consumption in normal times per ton of steel made.

Irrespective of savings that may be accomplished, every effort is being continued to build the manganese stockpile. Industries having special types of ore requirement have been asked to give advice. But tentatively it has been determined that there is probably little or no need for stocking special "chemical" or "battery-grade" ores at this time. Nevertheless, Metals Reserve Company will segregate material of this sort whenever it is offered if there seems to be any practical advantage in setting aside the material for special needs in time of emergency.

Some contracts are being arranged, a few have actually been closed, with domestic manganese producers who contemplate new mining development. Washington notes with great concern that some of these propositions appear to be leading to an undesirable type of financial exploitation. If unfair stock-selling programs are detected it is certain that drastic official action will be taken by the appropriate government authorities. The Defense officials do not intend to support or even to tolerate speculative ventures under the guise of defense contracts.

Some Priorities Ordered

THE FIRST STEP in establishing formal priority control of industrial materials needed in defense was taken by the President in an executive order published Oct. 24. This names a priority board composed of Knudsen, Stettinius, and Henderson serving in their capacities as industrial production, raw materials, and price stabilization members of the Defense Commission. This special priorities board at once designated Donald M. Nelson as its administrator. The board and the administrator acting in the public interest and the interest of national defense may require "persons with whom naval and Army contracts and orders have been or are placed, to grant priority for deliveries pursuant thereto over all deliveries for private account or for export."

It is not anticipated that this priority program will have to be extended to any very large number of commodities soon. However, the authority is adequate to regulate operations within any firm doing business directly for the Army and Navy. Initially, the authorization does not extend to subcontracts or indirectly to suppliers of materials needed for direct contract work. But there is no doubt that the President would extend this greater authority, and that there is legal basis for doing so, if any recalcitrant unit of industry should interfere with the defense program.

It should be particularly noted that thus far there is no effort to regulate priorities among the various industrial groups not directly involved in defense work. That latter type of priority regulation which prevailed during 1917 and 1918 will, according to present plans, be imposed only in the event of actual war. However, the present limited emergency gives a basis for even that detail of regulation should the government men decide it to be necessary.

More Zinc Needed

OFFICIALS ARE WATCHING both the supply and the price of zinc closely. During October industrial price policeman Leon Henderson, of the Defense Commission, commented officially on the 50 percent decline in producers' stock shown by a survey made by the Bureau of Mines at the request of the Defense Commission. Between April 30 and Sept. 21 consumers' stocks declined from 94,000 to 82,000 tons. This is emphasized as indicating that active buying has gone on but not to the extent that stocks are being unwarrantedly increased by users.

As further defense activities reach actual manufacturing stage, there may be genuine shortages of zinc supply, Washington fears. Effort is being made to encourage the industry in development of new production capacity and more aggressive operating schedules. Officials are apparently as much in hopes of thus preventing sudden price increases as in avoiding any shortage of supply.

News "Fines"

Alumina From Clay—Premature newspaper publicity regarding research on the making of alumina from clay has embarrassed TVA investigators. The process being considered is at an early laboratory stage and even the investigators themselves are not prepared to guess how well it will work or what the resulting alumina might cost. There is every reason to believe the conventional methods for making this raw material for aluminum manufacture from bauxite will have to be used generally for some time.

Silicosis Warning—The director of the Bureau of Mines, Dr. R. R. Sayers, again warns the industry against dust hazards as a cause of increased incidence of respiratory diseases. Speaking recently before the National Safety Congress, he points out that statistics clearly show an increased likelihood of bronchitis, influenza, and pneumonia for workers exposed to dust, even when the atmospheres are not such as to cause the more serious tuberculosis or silicosis hazards. This argument is one most commonly used in promoting the legislation desired by Secretary Ickes which would give the Bureau of Mines official authority to make inspections and mandatory safety regulations for the mining industry. Although the initial proposals are for the investigation of the coal mining industry only, there is not the slightest doubt in Washington that this authority would soon be extended to metal mining and the development of non-metallics, if officials had their way.

Mines Bureau Money—After considerable delay, the President authorized the Bureau of Mines to spend not to exceed $2,000,000 for special manganese investigations. The Bureau is proceeding at once with semi-works-scale pilot-plant construction in accordance with the recommendations of the technologic committee advisory to the Defense Commission. Novel milling methods, new concentration technic, and other beneficiation plans will be studied. Some work will also be done on leaching of ores and solution metallurgy.

St. Lawrence Power—The President, using defense funds, initiated the long-delayed St. Lawrence River power project when he ordered engineering work to start on the International Rapids section of the river. A new engineer corps division in association with Federal Power Commission will carry forward this undertaking immediately, the objective being a large power dam. This dam will be so built that locks can be added later if desired. This means that for the present the mining industry is not confronted with the threat of a plan making Duluth, Chicago, Detroit, and Cleveland seaboard ports. Until this later event happens, the economic impact on mining will be relatively limited, Washington believes.

Nitrate Troubles—Washington understands that resumption of shipping of nitrate from Chile was expected late in October. All communications from the nitrate fields to the principal coast ports were destroyed by tremendous floods. The delay was not only in movement of nitrate out, but also in movement of fuel in to the mines. Production as well as shipment was, therefore, temporarily reduced.

Up to late October the Defense Commission had not decided whether it would build some of its nitrogen supply on the basis of imported Chilean nitrate. The State Department is urging this policy instead of further building of synthetic ammonia plants. The objective would be to stabilize Chilean economy and help on Hemisphere defense. Neither Army nor civilian Defense planners like this theory very well, even for a small part of the program. Ultimately, it may be accepted, however, as plans for the larger military undertaking with four million men is scheduled.

Tungsten From China—Washington hopes that reopening of the Burma Road may re-establish another exit for tungsten from inner China. The Export Import Bank late in September agreed to loan China $25,000,000, at the same time anticipating that its affiliate Metals Reserve Company would receive tungsten valued at perhaps $30,000,000 during a period of years.

TVA Nitrate Plant—After one of the most bitter defense controversies it was finally decided that the Defense Commission would authorize the Army Ordnance Corps to contract with TVA for design, construction, and operation of an ammonium nitrate plant. This contract is similar to those made by the Army with private companies. The policy objection to this plan was the obvious fact that this gave TVA a new synthetic ammonia plant with which it could go into the complete fertilizer business most effectively in competition with private fertilizer companies after the emergency has passed.

More Economics Studies—To accelerate economics studies by the United States Bureau of Mines, Congress increased the funds available for that Branch by $85,000 per year. This represents about a 35 percent increase in activity from now until next July. In the same bill the Mining Division's field studies on strategic material reserves were also speeded up with a new appropriation of $275,000. That fund doubles the amount of field work that can be done during the rest of this fiscal year.

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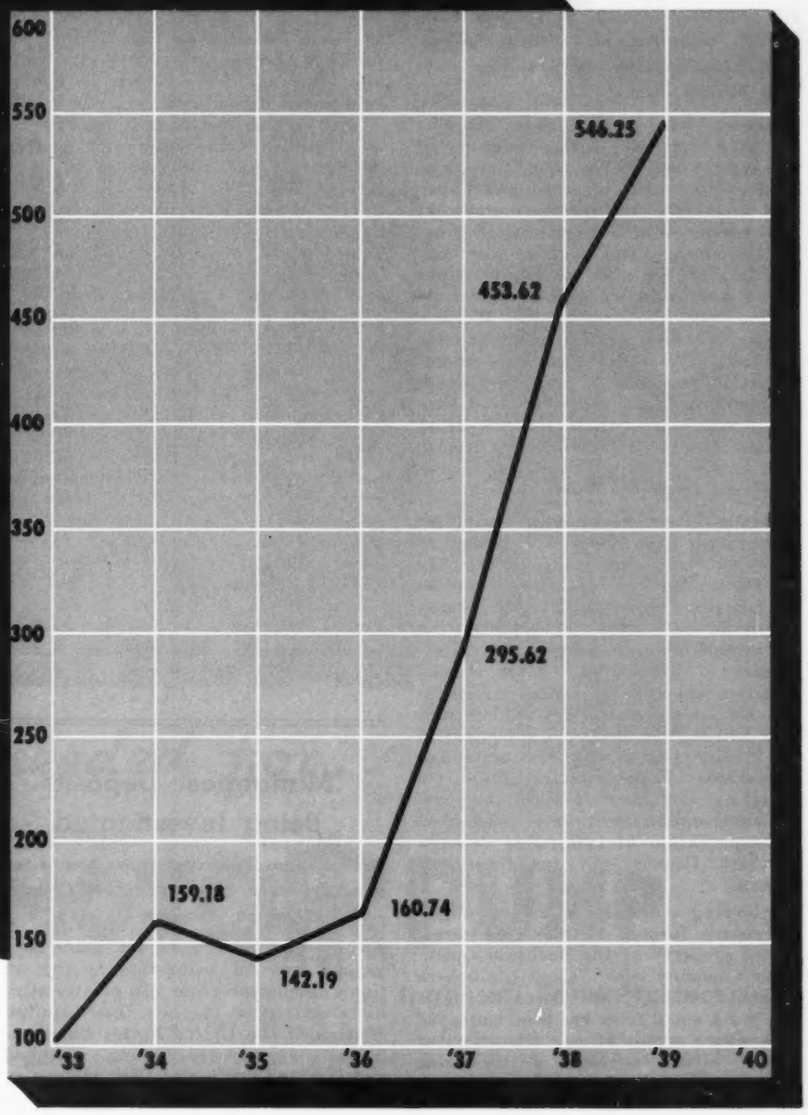

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NEVADA

New Flotation Plant Started in Humboldt County

Mill will have capacity of 175 tons daily to treat gold-silver ores—Manganese deposits being exploited by three companies near Boulder Dam

▶ Construction of a 175-ton flotation mill is to start at once on property of the West Coast Mines, Inc., known as the Pansy-Lee gold-silver mine and situated in the Barrett Springs district, 11 miles northwest of Winnemucca, in Humboldt County. The contract for construction of the mill, an 8-mile power line, and a 3-mile water line with pump station was awarded to the Western Knapp Engineering Company, of San Francisco. W. J. Kaminzind, of Sacramento, is president of the West Coast company and John F. Cowley, until recently in charge of the Brunswick mines of the Idaho Maryland Mines Corporation at Grass Valley, Calif., is manager, with office at Winnemucca.

▶ Bids will be received after Dec. 1 for construction of a manganese treatment plant at Boulder City, for which $1,375,000 has been made available under the Scrugham amendment to the defense appropriation measure signed lately by the President. The plant will be an expansion of the United States Bureau of Mines experiment station, in operation for several years, and will include four buildings, with housing equipment for 72 technicians with assistants and caretakers. Representative James G. Scrugham said that at least three responsible organizations have undertaken the exploitation of manganese deposits in Clark County, not far from this station.

▶ Following a month's operation, a 100-ton rotary furnace installed in August on the property of the Buckskin Quicksilver Company near National, northern Humboldt County, was closed down recently. A small force has been employed to develop a supply of ore. The cinnabar deposit is said to cover a large area on the crest of Buckskin Mountain, but is reported to be of low grade and of little depth. P. M. Anderson, of Winnemucca, is superintendent.

▶ Shipments of gold ore of highly profitable grade from the Talapoosa mine, in Lyon County, to the custom mill of the Dayton Consolidated Mines Company near Silver City have been maintained at the rate of 50 tons per day and lessees have shipped in smaller amount. The property was purchased late last year by Fred J. DeLongchamps, of Reno, from the late Col. W. Scott Proskey.

▶ Production of silver ore by lessees from old mines in the Candelaria district in Mineral County has been of substantial volume in late months, one lessee, starting in May, having shipped over 600 tons of $18 ore and some carlots having sampled over $50 per ton. The district, idle for many years, has produced around $33,000,000. Principal mines are owned by the Argentum Mining Company, controlled by New York and Colorado men. Recent sampling was said to show a reserve of 200,000 tons averaging 14 oz. silver and 0.06 oz. gold per ton. Fred C. Grube, of Los Altos, Calif., is manager and is now at the property.

▶ A new contract for delivery of 5,000 tons of manganese ore with minimum content of 48 per cent Mn, supplementing an earlier contract for 2,500 tons, has been awarded by the Federal procurement division to the Western Alloys, Inc., which has been developing manganese deposits in western Lander County and is completing construction of a 250-ton concentrator 5 miles from its mines, near the Lander-Humboldt County line. The product is to be delivered to the government arsenal at Ogden, Utah. P. A. Mattingly and J. F. Featherstone, of Salt Lake City, are heads of the company and D. B. Pelton, of Valmy, Nev., is superintendent.

▶ The old Searchlight or M. & M. mine, in the Searchlight district, southern Clark County, has been acquired under long-term lease and option by George I. Holmes of Los Angeles, discoverer of the Silver Queen mine, at Soledad Mountain, near Mojave, Calif., which was bought by the Gold Fields American Development Company and is being operated by its subsidiary, Golden Queen Mining Company. A contract for diamond drilling to prospect below the old levels, has been made.

UTAH

Manganese Deposits Being Investigated

United States Bureau of Mines begins testing of areas in Tooele and Juab Counties —Miners get pay increase

▶ Uncle Sam's search for low-grade manganese ores for utilization in the nation's defense program will greatly stimulate activity at the new Intermountain Station of the United States Bureau of Mines. The first trenching, sampling, and diamond drilling of Utah manganese deposits started early in November, with United States Bureau of Mines engineers in charge. A deposit in southern Tooele County and another in Juab County are to be tested, Paul T. Allsman, mining division engineer of the Bureau, announced. The Tooele County deposit lying in the south end of the Simpson range is the Huber-Rydalch property. The Juab County deposit, embracing the Pratt and Stotz properties, is owned by Utah interests.

▶ Dr. R. S. Dean, chief engineer, metallurgical division, United States Bureau of Mines, announced recently at the Salt Lake station that authorization had been received to start a million-dollar program of investigation. The program will include, he said, the construction of a $400,000 pilot plant at Boulder City, Nev., and experimental work at the Salt Lake City station, which will increase the staff of technical workers by 80 persons. Selection of a site for the pilot plant to be constructed immediately with its completion shortly after Jan. 1, 1941, has been delegated to Dr. Dean.

▶ Hollis Chatwin, of Provo, and Reed H. Richards, of Salt Lake City, are shipping manganese ore at the rate of a carload daily to the Columbia Steel plant near Springville, Utah.

▶ Effective Oct. 15, wages of mine, mill, and smelter workers were increased 25c. daily as the result of the advance in the price of copper. About 5,000 employees will be benefited by the change.

▶ Starting Oct. 19, mines at Park City and Eureka shut down for a week to allow employees a week's vacation at the opening of the deer-hunting season. This was the first "vacation with pay" ever enjoyed by Utah miners and resulted from the new labor agreement signed by operators and union officers last summer. At Park City, the pay day falling on Oct. 25 was advanced to Oct. 18 so that men on vacation might have money in their pockets.

▶ James B. Allen, president of the Marsac Mining Company, Beason Building, Salt Lake City, has reported a strike of high-grade ore on the 1,200 ft. level of the Park City property.

▶ Bingham lost a historic monument recently when the 125-ft. brick smokestack of the old Yampa smelter was razed by a blast of dynamite. The bricks will be used to construct a Mormon ward chapel. Utah Copper officials donated the building materials to the Mormon Church.

▶ Miners driving a drift in the 9,000 ft. Kentucky-Utah Mining Company's tunnel in Big Cottonwood Canyon have struck nine inches of good shipping ore, reports M. C. Morris, secretary-treasurer, Stock Exchange Building, Salt Lake City.

▶ The Cedar-Talisman mine, in the Star district near Milford, will be operated on a three-year lease by James Owens and associates, of Salt Lake City, George Baglin, president of the company, Felt Building, Salt Lake City, announces. Work will be started in the Stalworth shaft, last worked in 1910.

▶ Underground work at the Old Hickory gold mine, near Milford, will be started by the Prosper Mining Company when the ore being mined from a surface deposit at the rate of 100 tons a week is exhausted. To date, it is reported, this deposit has produced 66 carloads having a gross value of $45,000.

▶ Production will be increased at the Drum Mountain manganese ore deposit in Juab County to 200 tons daily within 60 days, announced J. W. Jones, Salt Lake City mine contractor, recently. New equipment is to be installed and ore trucked to Delta and shipped to the Columbia Steel plant.

▶ The Elton Tunnel of the National Tunnel & Mines Company has entered the Occidental fault at a distance of 18,275 ft. from the portal, officials report. At the last report, crews were making 15 ft. daily without difficulty.

▶ The Tintic Ophir Mines Company, operating at Lion Hill, Ophir, has rehabilitated its plant, which was injured by fire last summer, and struck a body of high-grade ore in the main tunnel.

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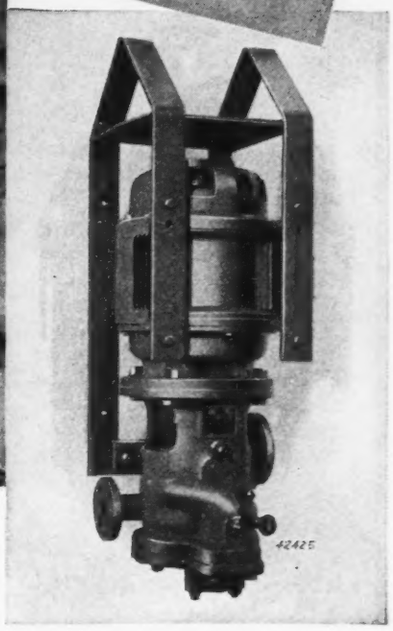

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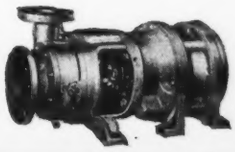

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IDAHO

Old Lead-Zinc Mines Resume Production

Higher metal prices encourage reopening of Constitution and other mines—Sunshine Mining Company driving crosscut on 3,700-ft. level

▶ The Highland-Surprise Consolidated Company and the Spokane-Idaho Mining Company, operating the old Constitution mine, both in the Pine Creek district near Kellogg, will soon resume production. Both properties are zinc-lead producers, with zinc predominating. They have been idle for a number of years. The Highland-Surprise will employ 60 men in mine and mill operation. A new crusher, classifier, a 15-cell flotation unit, and a filter will be added to the 200-ton mill. Sufficient ore is blocked out to produce at least 2,000 tons of ore a month. Dr. Charles R. Mowery, of Spokane, is president, and H. M. Huemann, of Wallace, is secretary-treasurer. The Spokane-Idaho Company has constructed a new power line and new mine buildings and is installing a new compressor. Site for a new milling plant has been selected by William P. White, manager, of Kellogg.

▶ Sunshine Mining Company is driving a new crosscut from the 3,700-ft. level to cut the vein system. This crosscut will give the company 600 ft. of new stoping ground below the present lowest mining operations on the 3,100 level.

▶ The Bunker Hill & Sullivan company has increased its capacity of smelting and refining facilities at Kellogg 15 per cent and is now producing 2,600 tons of lead and 140,000 oz. silver per month. The Sullivan zinc smelter, at Kellogg, is producing 1,300 tons of 99.99 plus pure zinc each 30 days. The company's new bismuth-antimony smelter and refinery is the only plant in the nation with a process successfully separating bismuth and antimony from the tetrahedrite silver-copper ores.

▶ Directors of the Tamarack & Custer Mining Company have declared a division of 2,000,000 shares of Sherman Lead Mining Company stock owned by the Tamarack company. Each Tamarack shareholder will receive two shares of Sherman Lead for every five shares of Tamarack owned. The Tamarack is producing 300 tons a day on a five-day week basis. The new 300-ton mill is operating at full capacity. Ore production is coming from below the No. 7 level. The Sherman Lead Company recently resumed production and will have its new 300-ton milling plant ready for operation in November.

▶ Morrison & Knudson, Boise contracting firm, are installing a 3,000-yd. electric dredge on placer property near Mountain City. A. I. Weaver, of Boise, is manager.

▶ The Securities and Exchange Commission and the Department of Justice on Oct. 24 reported that James R. Davies, of Boise, Idaho, president of Buckhorn Mining Company, was sentenced to fifteen months' imprisonment and the company was fined $1,000 on charges of violating the Securities Act of 1933 in the sale of unregistered securities. This is the first conviction where the indictment was predicated solely upon the use of the mails to sell securities without complying with the registration provisions of the Securities Act.

▶ The Mineral Mountain Mining Company will resume development work at its property in the silver belt by sinking the shaft an additional 300 ft. to the 600 level. A new air compressor is being installed. Fred Theil, of Osborn, is president.

▶ The Horn Silver mine, near Arco, in Butte County, will have a new $70,000 mill in operation early in November, according to William E. Clark, president and manager of the Era Mining & Development Company. Ore will be shipped to the Garfield, Utah smelter.

▶ Coeur d'Alene Mines Corporation, newest producer in the silver belt, started its new 300-ton milling plant early in November. Provision has been made to double the capacity of the mill to 600 tons on short notice by the addition of another ball mill and flotation equipment. The company has been delivering 240 tons of ore daily to the Hercules mill in Wallace. On the 1400 level the company has developed what is perhaps the largest and richest silver orebody ever opened in the Coeur d'Alene district. The orebody is 7 to 9 ft. wide and averages from 70 to 200 oz. silver per ton. Stoping operations above the main tunnel level show the existence of large mill ore reserves, with the vein averaging 7½ ft. in width. Dr. H. C. Mowery, of Wallace, is president. The office of the company is at Wallace.

MONTANA

Elm Orlu Zinc Mine to Be Reopened

Property of Anaconda Mining Company expect to be in operation early in 1941—Drilling at Emigrant Placer reveals another large gold area in prospect

▶ Zinc plants of the Anaconda Copper Company at Great Falls and Anaconda are now operating at near capacity. Eleven of the twelve units at Great Falls are now in operation, and it is expected that the last unit will be started in the near future. Each unit has a capacity of 2,300,000 lb. of zinc a month. The Great Falls plant has about twice the capacity of the newer plant at Anaconda. Zinc concentrates from Idaho, Utah, and other out of State points are received at the Great Falls plant. The Butte ores are both concentrated and refined at Anaconda.

▶ In a recent letter to stockholders, A. E. Mosier, president of the Lucky Tiger-Combination Gold Mining Company, stated that 33 holes have been drilled, 80 to 100 ft. in depth, on the Emigrant placer, Park County. These holes, based on reports of company engineers, indicate a yardage of eighteen to twenty million yards of commercial gravel averaging 27.6c. per yard from the top to a

depth of 90 ft., or a gross value of $5,550,000. This covers only 125 acres of the 1,500 in the property. However, the entire 1,500 acres is not dredgeable, and what additional acreage will be proved in the future is problematical. Drilling was discontinued because the acreage already proved will provide at least eight years' operation. At a recent meeting of the board of directors it was voted that the result of the drilling campaign, as reported by the company's engineers, justified the erection of a 10-ft. dredge on the property. Offices of the company are at 710 Commerce Building, Kansas City, Mo.

▶ An increase in zinc production from the Butte district may be expected early next year when plans are completed to reopen the Elm Orlu mine, idle since 1927, when it was last operated by Clark interests. The Anaconda Copper Mining Company acquired the property at that time by purchase of all Clark holdings in Montana.

COLORADO

New Tungsten Plant In Boulder County

Practice of roasting will be employed—Good records continue to be made at Carleton Tunnel

▶ A contract for excavations and foundations for a new tungsten mill at Boulder has been let by the Alloy Minerals, Inc. The mill will be 40 ft. by 65 ft. and will contain five floors. An innovation to local tungsten milling will be the installation of an ore-roasting unit. F. F. Beard, secretary-treasurer of the Alloy Minerals, Inc., is in charge.

▶ The total production of the Boulder County tungsten district from its discovery in 1900 to 1939 was approximately 20,650 tons of concentrates averaging 60 per cent of tungsten trioxide—a production more than 50 per cent greater than that of any other district in the United States. That summary of the Boulder County district is given in a new United States Geological Survey report, prepared in co-operation with the Colorado Metal Mining Fund and the Colorado Geological Survey Board. The final report is in process of preparation. Peak production of the district was during 1918, when the rate was 1,000 tons of concentrates a year; and since that time production has been at the rate of about 200 tons of concentrates a year, according to the report prepared by T. S. Lovering. There is necessary at this time an elaborate campaign of geological exploration and diamond drilling, whose success would be uncertain. The report says: "The areas believed most favorable for prospecting take the form of elongated areas close to the major breccia reefs that cross the district. Most of the ore minded has come from these areas. The tungsten deposits are spotty and often are contained in 'blind shoots.'"

▶ New high records were made by the Carlton Drainage Tunnel crew in September, when they advanced the tunnel

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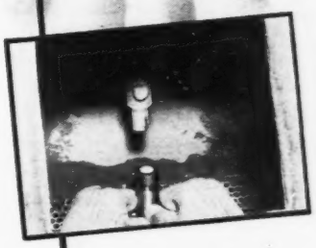

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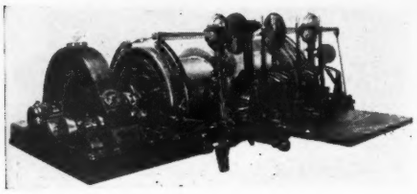

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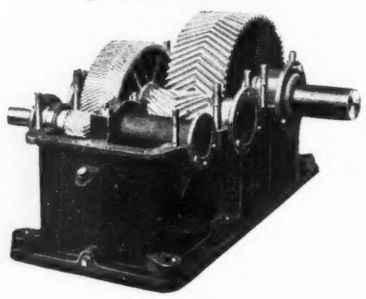

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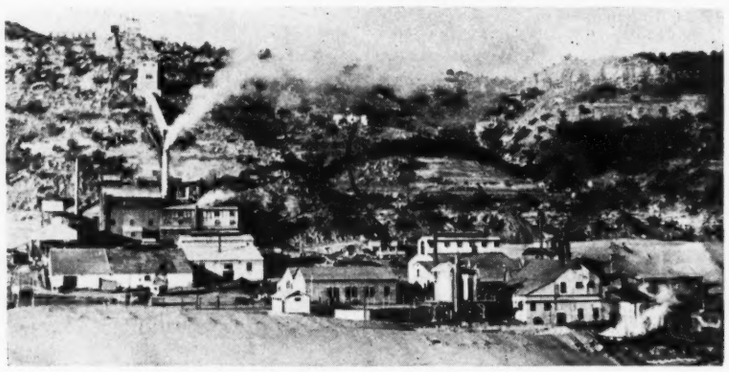


At Uravan, Colo., is the 240-ton plant of the United States Vanadium Corporation treating ores produced from many mines near by. Treatment involves crushing and screening to minus-ten mesh, roasting with salt, leaching, precipation with acid, and fusing of resultant precipitate.

▸COLORADO

1,704 ft. in 30 days, one day having been lost for repair work and retimbering. The first 4 miles of the tunnel were driven in 418 working days; the first 2 miles in 234 days, with an average daily advance of 45.1 ft.; and the last 2 miles have been driven in 184 days, with an average daily advancement of 57.4 ft. This makes an average daily advancement for the 4 miles of 50 ft. daily. The total drilling time for 4 miles was 5,180 hours; total mucking time 4,532 hours; total time for timbering 319 hours. Powder consumed per foot of tunnel was 31.95 lb.; and 4.94 caps were used per foot of advancement, making a total of 674,832 pounds of powder and 104,387 caps for 4 miles of tunnel work. The average cross section of the tunnel is 10 ft. high by 11 ft. wide and 117,755 cu.yd. of muck, or 5.6 cu.yd. per foot of tunnel, have been taken from the project.

▶ The Modern Gold Mines, Inc., inactive for several years in the Dunton mining area at Rico, has started work on its Emma mine. It is understood that they have taken over the Smuggler property at Dunton and are constructing a tramline from the Smuggler No. 4 level to the Emma mill. C. S. Porter is president of the company. J. L. Robison and C. O. Parker are in charge of operations.

▶ Jack Richards, operating a placer at Alma, employs a power shovel to load gravel into trucks which transport it to a washing plant. This gravel runs about 50c. a cubic yard. During one hour of operations early in October the trucks broke all records, and hauled gravel that contained gold valued at $5,600. This is one of three large placer operations at Alma.

▶ Don Schnell operating the Poorman property at Boulder, has developed ore on the 525-ft. level similar to that found on upper levels.

▶ The Golden Cycle mill has announced that effective Oct. 1 the mill will permit umpires and resamples on all ores of a value of 0.15 oz. gold or $4.91 per ton. No resamples will be permitted when mill assay is less than 0.15 oz. gold per ton.

▶ A contract calling for the sale of 10,000 tons of ferro-grade manganese ore to the Metals Reserve Company has been negotiated by R. Edgar Tippett, Barr Building, Washington, D. C., for the Fawn Manganese, Ltd., of Denver, Colo., whose new manganese mine is at Snowmass, Pitken County, Colo. The claims were located in July of this year by Mr. Howell, of the company.

▶ Charles L. Neilson recently obtained a contract from the Vanadium Corporation of America for 500 tons of roscolite vanadium-bearing ore. The Donegan property, at Sawpit, is under lease to Mr. Neilson.

▶ The Slide Mines, Inc., operating in Boulder County, have acquired under bond and lease the Alton tunnel and tungsten and gold properties, comprising about 40 claims located in the Grand Island district near Nederland, from A. R. Specht and the M & M Exploration Company, and have started cleaning out the tunnel and shaft on the Pinegrove property and the Little Jimmy.

OREGON

Cobalt Mine Optioned by U.S. Vanadium Corporation

Property will be examined—Gold placer operations continue well into winter

▶ United States Vanadium Corporation of America has taken an option on the Standard mine, for examination, seven miles north of Prairie City. The ore is cobalt found in large kidneys. Forty years ago this property was producing, employing about 100 men. The mill on the property was destroyed two years ago, by fire.

▶ Bonanza Mines, Inc., is installing a new rotary furnace with a capacity of 80 tons every 24 hours, at its property near Sutherlin. The ore contains 0.5 per cent mercury.

▶ Atlas Dredging Company, operating the largest drag line dredge in Oregon,

is using a 5-cu.yd. walking-type Marion dragline and 6,000 cu-yd. floating dredge on the Leonard Placer on Althouse Creek, in the southern part of the State.

▶Carson Channel Gold Syndicate reports 26c. in gold to the yard from 7,000 cu.yd. of gravel, 40 miles west of Baker. Because of imperfect water supply in hot weather, a 4-in. giant with 90-lb. pressure washed the gravel by day only. During the night enough water accumulated for another 8-hr. run. After fall rains, two giants are used. The company has 52 claims. E. J. Mimnaugh is manager.

▶Gold Cluster mine, on Chicken Creek near Huntington, is producing one ton of ore daily, valued at $50 a ton. A five-ton stamp mill and an amalgamator are used. Four men are employed.

▶Pacific Placer Company has 400 acres of bench gravels, 10 miles from Morman Basin, in Malheur County, which it is exploiting with a 3-in. hydraulic giant. A 36x60-in. vibrating screen with 1-in. openings is employed in washing and recovering the gold. Digging is done with two 85 hp. diesel caterpillars, one equipped with a bulldozer blade; the other a 20 cu.yd. Carryall scraper and LeTourneau ripper. The Carryall dumps its load over an 8-in. grizzly into a gravel bin. The gravel is washed over the vibrating screen, the undersize going to the sluice box and the oversize to a stacker belt. The equipment handles 100 cu.yd. per hour. E. H. Seaver is manager.

▶Western Gold Mining Corporation, on the Grande Ronde River, in northeastern Oregon, has a 5-cu.-yd. shovel which handles 4,000 cu.yd. of gravel a day, employing three shifts and 25 men. It adjoins the Carson Channel property. Will H. Simons, of Boise, is consulting engineer.

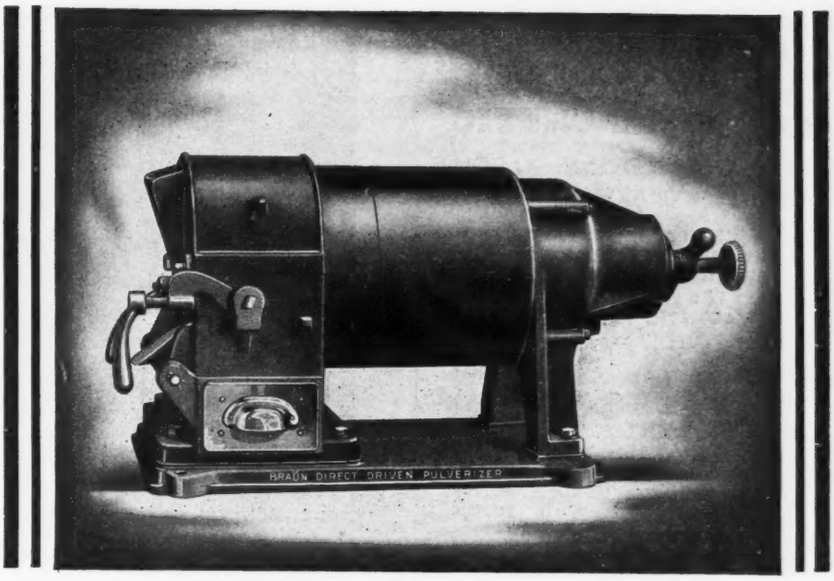
WASHINGTON

Magnesite Company Will Build Flotation Plant

Refinement in ore treatment under way—Grandview Mines receives first royalty check from American Zinc, Lead & Smelting Company

▶Northwest Magnesite Company, at Chewelah, will build a 300-ton flotation plant with which to remove inherent impurities in magnesium ores in that district. Dean A. W. Fahrenwald, of the School of Mines, University of Idaho, is supervising engineer for the mill construction. The mill to be built will make a product which will have a wide range of uses, from paper mills to the medical profession.

▶Grandview Mines Company has received its first royalty check for $2,350 from American Zinc, Lead & Smelting Company, which is operating the Grandview mill and mine, in the Metaline district. This payment is for a part of one month's run. It is expected the royalty hereafter will amount to more than $7,000 a month. D. I. Hayes, Spokane mining engineer, is in charge



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Write Dept. E-11 for Bulletin C-135 which gives complete details

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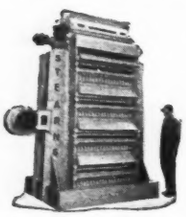

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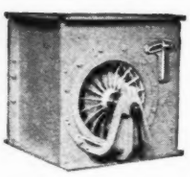

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A view of the 50-ton plant of the Western Molybdenum Company 60 miles north of Spokane, which started production and treatment of molybdenum ores in early November

for the American Zinc Company and also in charge of American Zinc Company's operations at the Metaline Mining & Leasing Company's property in the same district.

▶ Pend Oreille Mines & Metals Company has opened a new zinc deposit estimated at 100,000 tons of high-grade mill feed adjoining the company's major operations, near Metaline Falls. It is a surface deposit which can be handled by quarrying or open-pit mining.

▶ Royal Mines Company has moved mill equipment to its property, in northern Stevens County, where it will mine zinc-lead-silver ore said to average $40 per ton. A. T. Slawson is president of the company.

▶ National Rare Metals Corporation, of Yakima, Wash., has leased the tungsten property of Copper Mining Company in the Cascades. The owning company will receive a gross royalty of 20 per cent for the first 1,500 tons of ore milled and 12½ per cent thereafter.

▶ Western Molybdenum Corporation recently started operation of its new 50-ton mill at the Juno-Echo mine, 60 miles north of Spokane. On the 300 level the vein, 6 in. to 7 ft. wide, carries molybdenum, copper, gold, silver, and some nickel. R. S. Hartnell is superintendent, and H. C. Swann, of Spokane, is secretary.

▶ Alexander McLaren, of Livingston, Mont., has leased the Old Dominion mine, a famous early-day gold producer in eastern Washington. It is 6 miles east of Colville. Thomas G. Stevens, of Colville, has been operating the property on a small scale.

▶ Arthur P. Simonton has leased the old Electric Point silver mine to Los Angeles interests, who will install equipment to treat the large quantity of low- and medium-grade dump ore. Ore in the Electric Point has always been found in chimney deposits, and recently Mr. Simonton has opened a new deposit of this character. The property is near Colville.

▶ Thomas B. Hill, supervisor of the division of mines and mining in the Department of Conservation, has issued a bulletin covering mining laws of Washington.

ALASKA

First Clean-Up Made At Livengood Placer

Production started early in September—Gold Beach Placers, Inc., preparing for operations in the Nome district

▶ The 6-cu.ft. diesel-engine-operated Yuba dredge of the Livengood Placers, Inc., that started operations on Sept. 5 in the Fairbanks district, has been in steady operation, and results from clean-ups are reported to indicate a better recovery than first anticipated. Charles Lewis is in charge of operations at Livengood, Alaska. Callahan Zinc Lead Company owns a controlling interest in this enterprise.

▶ Gold Beach Placers, Inc., an Alaska corporation which has a large area in the Nome district, has been making progress in stripping the ground and has exposed enough gravel for operations the remainder of this season and for next year. A dragline, a 90-hp. engine, a 12x14 pump, and a 190-ft. pier out into Bering Sea are part of the equipment being installed. Various holdings have been consolidated by this company, among them being the Chilberg claim on the beach in the city limits of Nome, the Abbey claim, and the Swanberg claims.

▶ The antimony mine, on Stampede Creek, in the Kantishna district, has been operating at full capacity this summer. Several hundred tons of high-grade ore and concentrates are ready for shipment to the Alaska railroad this winter. The mine handles 35 to 40 tons of ore a day.

▶ William Ackerman and George Todd, of Valdez, have come out from a season spent in the remote Robertson River district, in the Tanana watershed, and report great ledges of ore bearing copper, iron, and several minerals unknown to them. Some of their samples they believe contain either tin or platinum. The streams were so impregnated with iron that the water was undrinkable. They staked many claims. To reach the

district, they said it was necessary to fly over a 10,000-ft. range of mountains.

▶ Nabesna Mining Corporation, in its report for the third quarter, covers the season's operation. Ore from old workings was handled for 1,200 hours, treatin 1,280.7 tons. The company has a new orebody on its Golden Eagle claim, on White Mountain, one mile from its present workings. It plans to develop this through a deep-level tunnel.

▶ C. L. Carlson is developing placer ground on Little Squaw Creek, in the Chandalar district north of the Arctic Circle, and he has extensive holdings on Big Creek, in the same district.

IRON COUNTRY

Consumption of Iron Ore Continues at High Rate

Low stocks anticipated by May 1941—Operators place orders for mechanized equipment for next year's high production schedules

▶ Consumption of iron ore will reach close to 6,000,000 tons per month during the winter months according to George M. Humphrey, president of M. A. Hanna & Company. If consumption continues at this rate, the ore stocks will reach a low figure by May 1, 1941. Observers believe the 1941 shipping season will be between 60,000,000 and 65,000,000 tons, as next year the steel industry expects a very high rate of activity.

▶ A few of the independent operators have finished their season schedules and most of the independents will have shipments completed early in November. The Oliver Iron Mining Company, however, will continue shipping late in November, and a few of the independents will be shipping until freeze-up.

▶ Canisteo Mining Company has closed its washing plant, having shipped a total of 478,000 tons of concentrates; and Mesaba-Cliffs Mining Company has completed washing operations at the Hill-Trumbull and Holman-Cliffs mines. Canisteo Mining Company will carry on an extensive stripping program during the winter months, and most of the independents will continued stripping and other clean-up work for a few months into the winter. The remainder of the work until spring will be winter repairs to equipment at mills and shops.

▶ Large orders have been placed for new motorized equipment at several of the mines, and the equipment houses have been forced to ask for spring delivery, as most equipment-manufacturing companies are working at capacity.

▶ Oliver Iron Mining Company has begun to receive deliveries on an order of 32 stripping cars of 30-cu.yd. capacity from the Austin-Western Road Machinery Company, Aurora, Ill.

▶ Charleson Iron Mining Company, of Hibbing, Minn., is preparing to develop an open pit mine near Aurora, Minn. The mine will be known as the "Harris."

▶ Taylor Mining Company resumed pro-

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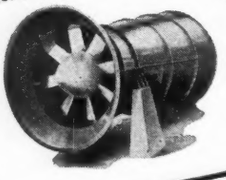

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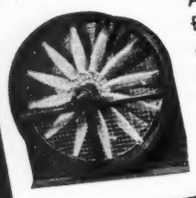

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▶IRON COUNTRY

duction at its Chataco open pit at Chisholm, Minn., on Oct. 8 and has orders for 20,000 tons of iron ore.

▶ Shipments of iron ore in October totaled 10,008,604 long tons. Total for the season to date is 58,296,354 tons.

TRI-STATE

New Mill Being Erected On Domado Lease

Plant near Cardin, Okla., will have capacity of 40 tons of zinc ore per hour—Rehabilitation of old mines continues

▶ Rialto Mining Corporation is constructing a new 40-ton per hour mill on the old Domado lease near Cardin, Oklahoma, to be placed in operation before the end of the year, according to Sam Ashe, company secretary, who is in charge of operations. A new derrick and 500-ton hopper were built recently over the old Domado mill shaft. Expanding operations of the corporation will not interfere with the re-treatment of tailings from the corporation's 200-acre tract over the Rialto mill that was converted into a tailing plant more than two years ago.

▶ Lula Bell Mining Company is sinking a new shaft on the Opperman lease, southwest of Baxter Springs, where the company for some time has been mining a rich body of zinc and lead ore from another shaft on the 160-acre lease. Site of the new shaft is about midway between the Frisco and K., O. & G. railroads, and west of the other shaft, which was put down a number of years ago by the Cortez-King Brand Mines Company. The shaft, which will be sunk to the 205-ft. level under contract to Bob Ballinger, of Joplin, will be in line with a series of drill holes that showed a good deposit of zinc and lead, according to Charles Barnett, of Joplin, president of the company.

▶ Jane E. Mining Company shut down its mill on the Scott land, east of Hockerville, on Oct. 5, and, with the completion of railroad connections with the mill hopper a week later, began the shipment of ore to the Central mill of the Eagle-Picher Mining & Smelting Company.

▶ Mining and milling operations have been resumed by the Pilot Mining Company on the Morrison and Skelly land, a mile north of Baxter Springs, after a three-month shutdown. Arthur Ward, of Baxter Springs, has succeeded Smith Testerman as superintendent.

▶ Eagle-Picher has reopened the Black Eagle No. 2 south field shaft, a mile northwest of Treece, and the Crystal and old Velie Lion mines, west of Cardin, employing approximately 100 men. Ore is hoisted at each of the three mines, loaded directly into railroad cars, and shipped by rail to the company's Central mill. The properties had been closed for some time. The company also has moved a 500-ton steel hopper from the Craig lease, southeast of Douthat, to the No. 2 mine shaft on the Grace Walker lease in the southeast part of Picher.

▶ The old Barnsdall Brewster mine, northwest of Baxter Springs, is being dewatered by the Bilharz Mining Company. A large quantity of lime is being used and a series of ponds and dikes have been erected for the treatment of the ferrous water to avoid pollution of Spring River. The system and methods for neutralizing the acidity of the water were worked out by O. W. Bilharz, of Baxter Springs.

▶ Beck Mining Company has taken over the operation of the mill and mines of the Sunflower Mining Company, Inc., a half-mile northeast of Hockerville, in Kansas. Mining and milling equipment of the Sunflower company, including the 300-ton mill, was acquired outright through purchase by Charles A. Beck, of Miami, president of the Beck company. C. W. Nicolson, of Miami, is company manager. Operations will employ 50 men, with Dewey Simms, of Baxter Springs, for many years superintendent of the Cortez-King Brand Mines Company, in charge.

MICHIGAN

Copper Range Company Signs Labor Contract

Miners' wages will be based on the sliding scale of domestic copper price

▶ Stating that "it is the desire of the parties hereto to promote mutual cooperation and harmony between the company and employees subject to this agreement," a contract was made and entered into Oct. 19 by and between the Copper Range company and the United Copper Workers Local No. 494 of the International Union of Mine, Mill and Smelter Workers (CIO). For a time a strike was threatened. The contract is retroactive to and begins on Oct. 1, 1940, and continues for a period of ten months to Aug. 1, 1941, when it automatically renews itself and continues in force from year to year thereafter, unless it is terminated by written notice given by either party to the other. The agreement recognizes the union as the sole bargaining agency. Wage rates will vary up and down with the price of copper. The new scale provides for wage increases for each one-half cent advance in the price of copper instead of for each one cent advance in the old wage scale. The increase is 10c. per shift until the metal reaches 12½c. per pound, when the increase is 20c. Thereafter it is 10c. with each one-half cent advance. The scale starts at 9c. with the basic rate $3.20. Decreases are made on the same basis.

▶ An average of 2,997 men were employed in the mines, mills, and smelters of Houghton County during the past year, according to the annual report of the mine inspector. There were 1,259 employed underground and 1,738 on surface and in the mills. Only three fatalities occurred during the year.

MEXICO

Thousands Strike at Rosita Zinc Smelter

Workers demand more pay and benefits totaling about $400,000 per year—Government asked to rescind 12 per cent export tax on metals

▶ Mexican mining's outlook was none too bright with the advent of mid-fall, what with decreased exports, and less profit from them, with the dollar around 4.85, and labor trouble, the greatest of which is the strike in the Nueva Rosita region, Coahuila, of 4,000 workers of Mexican Zinc Company and Cia. Carbonifera de Sabinas, S. A., the latter a coal company, both A.S.R. units, to demand more pay and other benefits that would cost 2,000,000 pesos ($400,000) a year. This strike threatens to close the Monterrey Iron & Steel Works, Monterrey, Nuevo Leon, Mexico's greatest enterprise of the kind, as the Nueva Rosita strikers flatly refuse to allow the shipment to the works of 8,000 tons of badly needed coke. There are reports that unless the strikers permit shipment of this coke, the Federal Government will intervene. This case is a dilemma for the government: it wants to please the miners, yet it cannot afford to have the Monterrey works close.

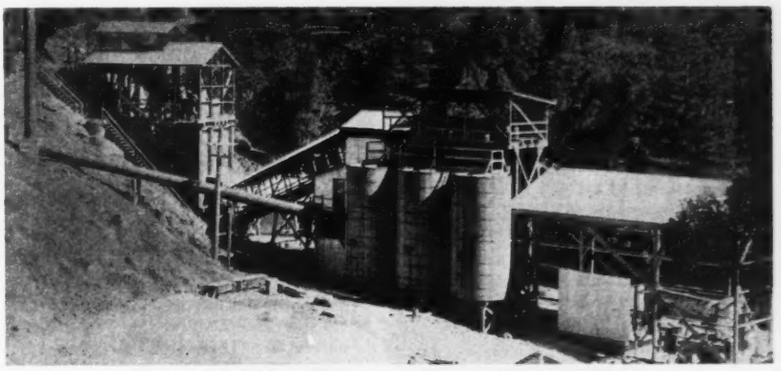
▶ Mining has been assured by the Federal Government that prompt attention is being given its petition to rescind the 12 per cent tax on exports which has been in effect for two years. Mining asked that this tax be abolished because it was enacted to enable the government to share with mining in extra profits from exports when the dollar was six to one. The dollar rate is now around 4.85. The government's investigation of the petitions is to ascertain whether or not abolition of this impost will benefit the whole industry or just a few sectors of it.

▶ Troops are protecting mines of Albert Genty, American operator, at Las Coloradas, Durango, from raiders whom the government avers are disgruntled cooperative miners but not rebels. This protection was asked by Pedro Malda, manager of the Genty properties.

▶ Conversations are being held in Mexico City to arrange for the permanent turning over to its workers of El Bote Mining, Zacatecas, Zacatecas, of which M. MacKay is general manager. The national miners' union asked the Federal Labor Department to make permanent agreements entered into when the workers took charge of the properties at the time the company went into liquidation early in the summer.

▶ Mining has given the government yet another acute problem. The National Mining Council, saying that the decreased demand for Mexican silver abroad has hit the industry hard, has asked the government to provide money to aid cooperative and small-scale miners.

▶ Unnamed American interests are examining the old La Dura gold and silver zone near Ciudad Obregon, Sonora.



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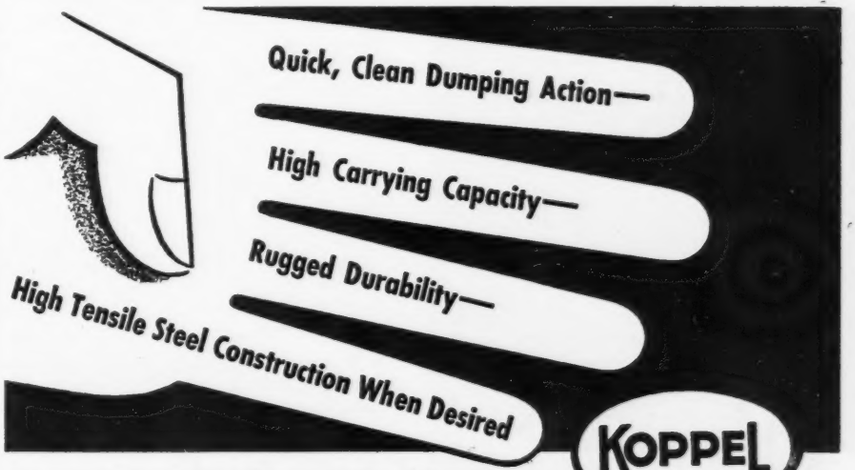

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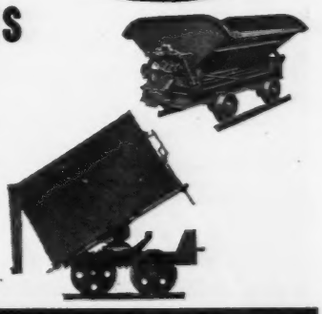

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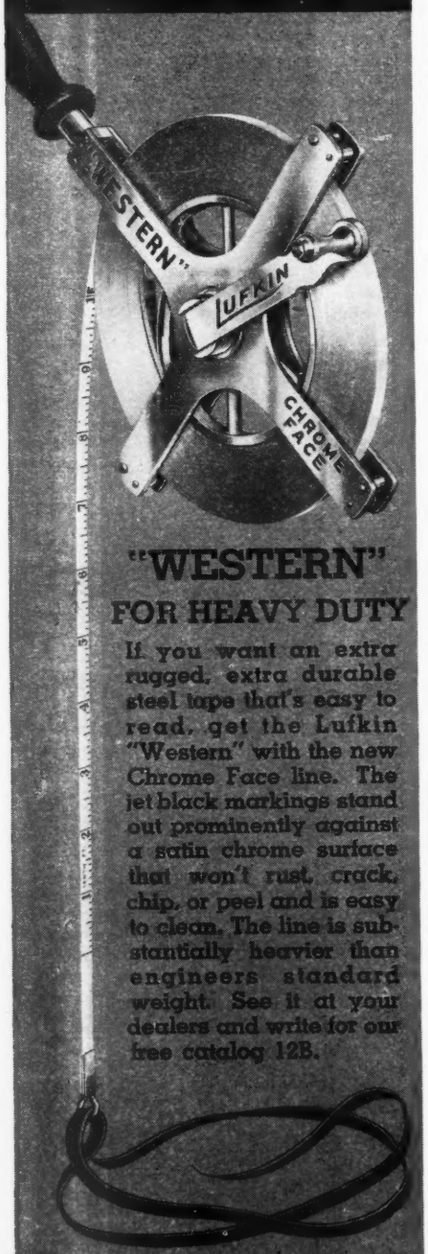

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CANADA

Dominion Gold Production Reaching New High

Total mineral output during 1940 expected to be valued around half billion dollars—Preston East Dome Mines plans increase in mill capacity

▶ Production figures for the first six months of 1940 show that Canadian mines are this year breaking all previous records. Gold bullion for the full year is estimated at $205,000,000, with an average of $16,655,104 per month reported for the first seven months. Copper, nickel, and other metallics will have an estimated value for the year of $176,600,000. Total mineral output in 1940 is expected to exceed half a billion dollars.

Ontario

▶ Ontario gold mines milled 7,733,464 tons of ore for a gross recovery of $81,186,976 in the first eight months of 1940, a gain of more than eleven millions over the same period last year. The average grade per ton was $10.50, compared with $9.98 in 1939. In August, for the fourth month in succession, a new record was made for gold, valued at $10,470,841. This output came from 62 mines, compared with 19 producers in the month of March, 1933, with an output of four millions.

▶ Tonnage possibilities of Presten East Dome Mines resulting from the program of exploratory diamond drilling now in progress have led to consideration of an increase in mill capacity to 1,000 tons a day, compared with the 600-ton rate now in effect. From the sixth level down to the tenth, drilling results of great potential importance for the mine's future have led to estimates of ore in the three main zones more than double the tonnages indicated at upper horizons. Late in October crosscutting was started on the bottom, or 1,750-ft. level. A series of six veins carrying high-grade ore are being explored.

▶ Sturgeon River Gold Mines reports the discovery of a new high-grade vein parallel to the main No. 3 vein. This important development has taken place in drifting on the 1,580-ft. level close to the shaft. Crosscutting is being started on the bottom, or 1,750-ft., level, where more favorable conditions are indicated for the occurrence of parallel veins.

▶ Jason Mines, formerly the Argosy property, Patricia district, is building up a strong treasury position, according to a report by the consulting engineer, John H. Colville. On the new fourth level ore grading $39.55 over a width of 17 in. has been opened for a length of 322 ft. The mill shows average recovery for August of $17.99 a ton from 122 tons a day. Ore reserves are estimated at 151,788 tons, calculated on the basis of a 40-in. stoping width. Debts of $185,000 are expected to be paid off next year. A. Deane is mill superintendent.

Quebec

▶ The main ore zone at East Malartic Mines has been intersected by horizontal drill holes at three points below the bottom, or 820-ft., level, according to a report by J. P. Norrie, vice-president. At the lowest horizon, No. U-395 hole was drilled from the 1,570-ft. level station and cut 46.3 ft. of ore averaging $6.13 cut grade. The No. 3 shaft has been completed at a depth of 1,720 ft. and a block of six new levels will be opened this winter. Broken ore reserves have increased to 419,916 tons. The mill is treating an average of 1,558 tons daily, averaging $6.29 a ton.

▶ Pandora Cadillac Gold Mines and Amm Gold Mines are reported to be operating successfully under an agreement that was recently ratified by shareholders of both companies. In June, the last month of milling under Amm control, production amounted to $33,103. The mine was badly handicapped by debts and small ore reserves. Under the new set-up, Amm's managing director, O. L. Knutson, continues in charge; and Pandora takes over all Amm assets and liabilities in return for 500,000 shares of stock and a quarter of the net profits until a total of $27,750 has been paid. The large Pandora property is on the main Cadillac "break" adjoining Amm, and has a substantial block of ore developed from two shafts.

▶ After relogging more than 60,000 ft. of drill cores at Lake Dufault Mines, additional deep diamond drilling has been in progress following up new data on the location of the main rhyolite-andesite contact. Several of the holes included in last year's 27,000 ft. of drilling have been deepened another 500 ft. to reach the horizon of the lower "A" orebody on the adjoining Waite Amulet property. Arrangements are being negotiated with Amulet for mining the Lake Dufault portion of the high-grade copper ore.

▶ At Francoeur Gold Mines, development of the north ore zone is continuing successfully. Two raises 175 ft. apart have been driven from the second level into the orebody, which is in a nearly horizontal position, due to a flattening of the rake. This is believed to be only a local condition. Raises are to be put up at regular intervals as long as the flat position is found to persist above the second level. The 250-ft. level drift has enlarged the lower orebody to a length of 305 ft. with an average value of 0.174 oz. across 6.4 ft.

British Columbia

▶ The third-quarter statement of Bralorne Mines, Ltd., operating in the Bridge River district, shows continuance of the steady production of the past year. From 46,267 dry tons milled, a recovery of 25,649 oz. gold was made, bringing the total recovery for the first nine months of the year to 76,733 oz. gold from 144,920 dry tons milled. Bralorne employees have voted 253 to 157 against continuing the system of cooperative collective bargaining in effect at the Bridge River property for the past five years. It is indicated that the local union of the International Union of Mine, Mill and Smelter Workers, a

C.I.O. affiliate, may be chosen by the employees as the official bargaining agency in the near future.

▶ The Sheep Creek Company, in the Ymir district, has formed a wholly-owned subsidiary to take over and operate the recently purchased Lucky Jim base-metal producer at Zincton, B. C. The new company will be known as Zincton Mines, Ltd.

▶ The Monarch base-metals mine, situated near Field, in the Golden mining division, may continue to operate longer than was anticipated when the property was reopened last December. The increasingly active market for zinc, caused largely by the accelerating reduction in visible American supplies, holds forth a definite promise of better prices and a possibility that the Monarch mine, together with many other base-metal operations in the province, will be able to develop and treat large bodies of lower-grade ore which in the past have been regarded as not commercial. Lower grade extensions of the East Monarch orebodies are now definitely assuming a profitable aspect. In the Monarch-owned Kicking Horse mine, adjacent to the Monarch, there are 30,000 to 50,000 tons of ore which at the present price of zinc are sufficiently valuable for mining. It is understood that this is now under consideration.

▶ Fire in the mill of the Kelowna Exploration Company's property at Hedley, B. C., has caused a temporary shutdown of that operation. A small fire, started in the mill while some welding was being done, was thought to have been completely extinguished. The blaze broke out again while the mill crews were changing shifts and did damage estimated at approximately $30,000 before being brought under control. It is stated that the mill will probably be shut down for at least six weeks, due to the difficulty of obtaining required repair parts.

▶ Spectacular showings, running more than 1 oz. gold per ton across 12 in. over a length of 125 ft., are reported from the Trophy group, in the Bedwell River area Vancouver Island property of the Lions Mining & Prospecting Syndicate.

▶ The Copper King mine, in the Kamloops mining division, under lease and option to McKelvie brothers, of Kamloops, has many indications of becoming a profitable producer, according to recent reports. Development work to date has been hindered by lack of capital, but if indicated orebodies come up to present expectations, the 35-ton diesel-powered flotation plant now on the property will operate at capacity for a considerable time. Sorted ore from one section of the mine shows up to 68 per cent copper and 1.10 oz. gold per ton.

▶ The annual autumn upsurge of activity in placer mining is well under way with the beginning of the low-water season on the gold-bearing creeks and rivers of the province. Northern Resources, Ltd., on their big dragline operation in the Atlin mining division, are reported to be working day and night with results better than are usual in that district. Near Stanley, in the Lightning Creek district, close to the scene of one of the richest placer operations in the history of the Cariboo district, R. McDougall claims to have uncovered the long-sought pre-glacial high-level channel of the old Lightning Creek.

▶ The annual Western meeting of the Canadian Institute of Mining and Metallurgy will be held at Vancouver, B. C., Nov. 13 to 15. High-lighting the meeting will be an address by Institute President, George C. Bateman, Metals Controller for Canada, and a paper to be read by E. G. Gaylord, chief petroleum engineer of the Standard Oil Company of California, on "Advances in Oil Production Practices in the United States in Recent Years."

AFRICA

Vlakfontein to Build Large Plant

Rapid development of gold property under way—South Banket Areas rushes mill erection—South Rhodesia producing more gold

▶ The technical advisers of the Vlakfontein Gold Mining Company have recommended the immediate erection of a reduction plant of 20,000 tons per month capacity. Though ore reserves are not yet large, developments are said to justify the expectation that the Sub Niger shoot system extends into the property. Ore so far proved averages 9.4 dwt. per ton over widths averaging 36.3 in. Three other companies, Lace Propriety, Anglo American, and New Consolidated Goldfields, have agreed between them to advance to Vlakfontein up to £550,000 to bring its property to the production stage. It is expected that construction work on the new plant will begin soon.

▶ Encouraged by the high price of gold and eager to assist in financing the war, the mines of Southern Rhodesia produced more gold in August than in any previous month for 23 years. Their output of over 500,000 oz. the first eight months of this year is greater than for either of the two preceding years.

▶ On the Gold Coast, South Banket Areas has suspended underground development in order to use its entire working force on the erection of the mill, headframes, power units, ropeways, and other preparations for productive operations. It is planned to have all this work completed within about a year. In the mine 672,220 tons of ore averaging 5.58 dwt. per ton over 42.2 in. has so far been developed.

▶ Luipaards Vlei is getting its new mill near its recently completed Turk shaft into operation and increased its crushings by 13,000 tons in September, to 75,000 tons. Net earnings were £40,055, with new high records for both tonnage and profits. It plans to raise the monthly tonnage to 100,000.

▶ Roan Antelope is again paying 6d., bringing its total payment for the year up to 1s., or 20 per cent on its 5s. shares. Beyond that payment and an allowance

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▶AFRICA

for depreciation its considerable profits for last year will go to the Government to help pay for the war.

▶The award of arbitrator Sir Robert McIlwaine in the labor dispute of March, 1940, between Northern Rhodesia Mineworkers Union and the Rhokana Corporation, Ltd., Mufulira Copper Mines, Ltd., and Nchanga Consolidated Copper Mines is, that no case has been made out for any increases and from a strictly financial point of view Sir Robert was of the opinion the basic daily wage from 28s. to 20s. per shift was not only good but generous. Allowances received by workers include cash bonus and provident fund plans financed by employers based on the sliding scale price of wire bar copper. Evidence in the investigation did not support the claim that working conditions were bad. Europeans and natives of Roan Antelope Copper Mines Ltd., refused to join in the strike. Nchanga agreed to be included in the proceedings but workers of that company did not strike.

AUSTRALIA

Lake View Mine Reports Rich Gold Strike

Deep crosscut from adjoining property discloses vein 61 ft. wide averaging 1 oz. in gold—Mount Morgan resumes operation of copper smelter

Western Australia

▶An interesting development has occurred in the Lake View Consols lease of Lake View & Star, Ltd., Kalgoorlie, where a crosscut put out from the 2,650-ft. level of the adjoining Great Boulder mine has intersected a lode of an apparent width of 61 ft. with assays averaging 1 oz. per ton. The new lode is in a virgin section of the Lake View Consols lease.

▶Another Kalgoorlie company registering an important development lately is Kalgoorlie Enterprise, in which a controlling interest is held by Boulder Perseverance, Ltd. A crosscut from the 2,050-ft. level of the Perseverance mine has intersected an orebody 20 ft. wide and assaying 7 dwt. The importance of the discovery lies in the fact that this is the deepest orechannel located on the north side of the Boulder dike, and gives promise of a considerable increase in the mine's ore reserves.

▶The new mill of North Kalgurli (1912), Ltd., Kalgoorlie, which is situated on the Croesus Proprietary leases, started operations in early October. The mill is of 7,000 tons monthly capacity, but is designed to enable an increase to double this tonnage. The flotation process, with roasting and cyanidation of the flotation concentrate, is to be employed, but provision has been made for the incorporation of precyanidation should circumstances render it desirable. The mill was designed by A. F. B. Norwood, consulting metallurgist, of Kalgoorlie.

▶Shareholders of Lancefield (W.A.) Gold Mine, N.L., have decided to wind up the company. Work ceased at the mine at Beria some months ago following on extensive ground movements in the lower levels.

Victoria

▶Wattle Gully Gold Mines, N.L., the leading producer on the Chewton field, had another profitable period during the half year ended June 30, netting £A38,-170. Ore crushed totaled 16,220 tons, from which 5786 oz. gold, an average of 7.1 dwt. per ton, was recovered. Dewatering operations at No. 2 shaft, in the northern section of the property, are expected to be completed in about three months' time.

▶Several interesting discoveries have been made at Bendigo lately, among them the intersection of a vein in the west crosscut at the 265-ft. level of the Forbes Carshalton mine, which is believed a western faulted back, on which the ore deposits occur; and in the North Deborah mine the cutting at a depth of 783 ft. in the shaft the east back of a reef 4 in. wide showing gold. This is believed to be the continuation downwards of the inner reef being worked in higher levels by the Deborah and North Deborah companies.

▶Freeburgh Dredging, N.L., Freeburgh, near Bright, has commenced operations with the satisfactory initial recovery of 62 oz. gold from 13,000 cu.-yd., dredged in eight days. Average grade was 2.3 grains per cubic yard.

▶Maude and Yellow Girl Gold Mining Company, N.L., Glen Wills, recorded the satisfactory net profit of £A11,867 for the year ended June 30, over £5,000 greater than in the preceding twelve months. George Barker is mine manager.

▶Silver Creek Quicksilver Mining Company, N.L., is being formed to take over a lease of 40 acres 15 miles east of Jamieson, and to develop the mercury deposits known to exist there. Demand for mercury is increasing in Australia.

Tasmania

▶A discovery of alluvial tin, made recently 4 miles from Williamsford, on the west coast of Tasmania, has been followed by the uncovering of a lode formation, which has been proved by surface trenching for a length of 300 ft. The lode is being driven on at a shallow depth. A trial crushing of 3 tons of ore gave a recovery of 196 lb. of tin concentrate.

▶Briseis Consolidated, Derby, sluiced 63,000 cu.yd. during August, and recovered 63 tons of tin concentrate, an average of 2.24 lb. per cubic yard.

New South Wales

▶Zircon Rutile, Ltd., treating beach sands near Byron Bay, on the north coast of New South Wales, is experiencing an improved demand for zircon.

(*Continued on page* 90)

NEW BOOKS

FIRE ASSAYING. *By Orson C. Shepard and Waldemar F. Dietrich. McGraw-Hill Book Company, New York and London. Pp. 277. Price $3.*

IN WRITING THIS BOOK the authors have planned to meet the requirements of several groups of people: (a) self-instructed students who want to familiarize themselves with sound methods; (b) students in technical institutes who do not intend to take a complete course in metallurgy; (c) practicing assayers who want a good reference book; and (d) college students of metallurgy. Under this plan the book is so arranged that the practical aspects of fire assaying can be obtained without delving into the physiochemical principles involved. In addition to the customary information on the subject, the book contains useful chapters on the fire assay for the platinum metals, the preparation of gold and silver bullion from analgam and cyanide precipitate, and the assay of various metallurgical products. Minimum equipment and supplies for a small assay office are listed. For the metallurgical student a chapter is devoted to a discussion of the principles and processes of fire assaying and related smelting processes.

PUMPS. *By Frank A. Kristal and F. A. Annett. McGraw-Hill Book Company, Inc., New York and London. Pp. 339. Figs. 385. Price $3.50.*

ALTHOUGH THIS WORK does not pretend to give a comprehensive presentation of types of pumps and their applications, it goes a long way toward filling that need. Being a book for the user of pumps, it is written from the practical man's viewpoint. It is intended to help him select pumps for the applications for which they are best suited. Hence considerable space is devoted to descriptions of various types of pumps and their performance. Chapters are devoted to reciprocating, centrifugal, turbine, propeller, rotary, deep-well, boiler-feed, sewage and sludge, and variable-displacement and proportioning pumps. Other topics treated are: head, pipe size, pump drives, and troubles and remedies.

EXPLORATION GEOPHYSICS. *By J. J. Jakosky. Printed by Times-Mirror Press, Los Angeles, Calif. Pp. 786. Price $8.*

LONG KNOWN to the mining industry as a consulting geophysicist, Dr. Jakosky has recently been appointed Dean of the School of Engineering and Architecture of the University of Kansas. His book will be welcome to engineers and geologists the world over—to all, in fact, who have so long wanted, in English, a comprehensive and practical book of instruction and reference on geophysical prospecting and exploration. The scope of the new work is the widest possible, embracing theory, equipment, and field technique. The arrangement of the contents is indicated by the headings of the twelve chapters: I, Instruction; History. II, Geologic and Economic Background. III, Magnetic Methods. IV, Gravitational Methods. V, Electrical Methods: Potential and Resistivity Methods. VI, Electrical Methods: Magnetometric and Inductive Methods. VII, Seismic Methods. VIII, Geochemical Methods. IX, Geothermal Methods. X, Drill Hole Investigations (Borehole Methods). XI, Physical Principles Applied to Production Problems. XII, Common Permit and Trespass Practices; Insurance. A valuable addition to the book is the long and complete list of United States and foreign patents. This is broken up into groups, so that each chapter is followed by the patents that are related to that portion of the text.

THE MINERAL INDUSTRY DURING 1939. *Edited by G. A. Roush. McGraw-Hill Book Company, Inc., New York and London. Pp. 761. Price $12.*

VOLUME 48 of this annual statistical and economic record of the mineral industry continues the fine traditions of its predecessors and offers an unexcelled review of conditions in 1939. Some statistics are incomplete, particularly for countries at war, because production and trade statistics are now regarded as strategic information of value to an enemy. Otherwise, the volume is up to the high standard of previous books in the series. Technology finds an important place in the reviews of the principal metals and minerals.

III. JOURNAL DESCRIPTIVE OF THE ROUTE FROM NEW YORK TO REAL DEL MONTE BY WAY OF TAMPICO (dated Real del Monte, Mexico, July 16, 1824). *By one of the first detachment sent by the Real del Monte Company. Pp. 76.*

A COPY of this interesting reprint was received some time ago through the courtesy of M. H. Kuryla, managing director of the Cia. Real del Monte y Pachuca, at Pachuca, Mexico. The title of the Journal as given above is almost sufficiently descriptive in itself. The account of the journey from Tampico up to Pachuca over 124 years ago is fascinating, even if the trip was more disagreeable than pleasant, because of weather and lack of civilized lodgings enroute, and fraught with dangers of various sorts. At any rate, the scribe who kept this diary, a much traveled person, found the trip one of the most interesting he had ever made by reason of the constantly changing scenery and the abundance of new specimens afforded by the fauna and flora of the country.

OPERATION AND MAINTENANCE OF ROCK DRILLS. *By Earl A. Drechsler. Published by the author, Sherridon, Manitoba, Canada. 4½x6½. Pp. 54. Three diagrams. Price $2.*

A NEW HANDBOOK of practical use for the miner, shift boss, and superintendent, by an experienced operator who is a "rock-drill doctor." It embodies the kind of information that seldom gets into print, but which is needed when someone is in trouble. Then an experienced man usually remedies the difficulty but does not always pass on to others the knowledge he has gained. This the present author does in a practical manner. The booklet contains folded drawings of stoper and drifter drills, suitably marked to explain their construction and method of operation.

▼ ▼ ▼

PUBLICATIONS

RECEIVED

U. S. Geological Survey has issued the following (for sale by Superintendent of Documents, Washington, D. C., at stated price): Bulletin 922-B, "Quicksilver Deposits of Mount Diablo district, Contra Costa County, Calif." pp. 31 to 54, inclusive, plus maps, price 10c. Also Bulletin 922-D, "Chromite Deposits of Grant County, Oregon," pp. 75 to 113, inclusive, plus maps, price 45c. Also Bulletin 922-F, "Tungsten Deposits of Boulder County, Colorado," pp. 135 to 156, inclusive, plus maps, price 20c. Also Bulletin 922-G, "Manganese Deposits at Philipsburg, Mont.," pp. 157 to 204, inclusive, plus maps, price 40c. Also Professional Paper 194, "The Gold Quartz Veins of Grass Valley, Calif.," pp. 101, plus maps, price $2.50 (paper).

U. S. Bureau of Mines, Washington, D. C., has issued the following Information Circulars and Reports of Investigations (no charge is made):

Information Circular 7130, "Testing Respiratory Protective Equipment for Approval." pp. 9. Also I. C. 7134, Production, Employment, and Output Per Man in Gypsum Mining, pp. 17.

"Report of Investigations 3528, Stemming in Metal Mines." Progress Report No. 2, pp. 39. Also R. I., 3531, "Air Flow at Discharge of Fan-Pipe Lines in Mines," pp. 14.

Mines and Geology Branch, Canada Department of Mines and Resources at Ottawa, has issued the following: Bureau of Mines Bulletin 803, "Talc, Steatite, and Soapstone; Pyrophyllite," pp. 146, price 50c.

Dominion Bureau of Statistics, at Ottawa, has issued the following: "Report on the Miscellaneous Non-Metallic Minerals in Canada, 1939," pp. 31, price 25c.

Gold Hill Mining District, Boulder County, Colorado, Preliminary Report on. By E. N. Goddard, Vol. 14, No. 4, Proceedings of Colorado Scientific Society, Denver, pp. 103 to 128, plus maps, price $1.

Idaho Bureau of Mines and Geology, Moscow, Idaho, has issued the following: Press Bulletin 19, "Abridged Bibliography of Mineral Industry of Idaho," by W. W. Staley, pp. 8, plus map. Also, Pamphlet 54, "Mining Activity on North Fork of Clearwater River Area," by W. W. Staley, pp. 6, plus map.

Tanganyika Territory. Annual Report, 1939, of Geological Division, Dar es Salaam, Pp. 28, price 1s, 6d.

Credito Minero y Mercantil, S. A. Bulletin, Vol. 1, Nos. 1, 2 and 3, dated May, July 15, and Sept. 15, 1940, respectively. This new publication printed in Spanish is published by the company named, at San Juan de Letrán, No. 11, Mexico City, Mexico, and contains, according to plan, brief reviews of local and world events which affect the metal market.

The Zinc Industry. A Mine-to-Market Outline. By Ernest V. Gent, secretary, American Zinc Institute, New York. A non-technical treatise of zinc from ore in the ground to finished zinc products. Historical and economic data. Sent free on request.

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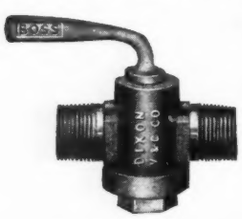

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▶AUSTRALIA

Plant extensions, increasing capacity about 70 per cent, were completed recently, and further enlargement is under consideration.

Queensland

▶Smelting operations at Mount Morgan have been resumed, and blister copper was produced on Aug. 23. The plant now has a capacity of 500 tons monthly. Treatment difficulties which were experienced in the sulphide mill as a result of the treatment of acid ore have now been overcome and the mill is running at full capacity.

▶The magnesite deposits at Marlborough, about 80 miles north of Rockhampton, are receiving some attention. The mineral is high grade.

PHILIPPINES

Ore Shipments to Japan Continue Unchanged

Threat of embargo prevails—President Quezon withdraws four gold-bearing areas from public lands

▶War clouds over the Orient so far have not interfered seriously with the Philippine mining industry, nor is there any sound reason to expect that they will. Gold production continues with almost monotonous regularity to establish new records; the total value of bullion and concentrate shipped during the first three quarters of the year was around 56,000,000 pesos, compared with 53,500,000 pesos for the same period in 1939, another new all-time record. The base-metal industry has the threat of an embargo on ore shipments to Japan hanging over its head, but so far this threat has not materialized, and the iron mines are making regular shipments as usual. Though there is more or less difficulty in obtaining sufficient bottoms for the demand of ore, as might be expected under present world conditions, the mines are going ahead on regular operation.

▶Dividends paid so far this year amount to 13,767,452 pesos, from 21 companies, as compared to 16,850,233 pesos from 17 companies in 1939. Lower disbursements by the three leading producers, Benguet, Balatoc, and San Mauricio, account for the decline. Much of the surplus ordinarily available for dividends has been used to pay for extra supplies and equipment, and better cash positions should be reported as these commitments are cleared up.

▶Several developments of extreme importance to the mining industry have featured mining activity during the past quarter: the opening of certain hitherto state-reserved mining areas to active development, the approval (backed by financial assistance) of the Commonwealth Government to the exploration of potential petroleum fields, and the decision of the larger operators to discontinue the policy of maintaining large (eighteen months in most cases) supplies of equipment and supplies in favor of the usual practice of buying for three to six months ahead.

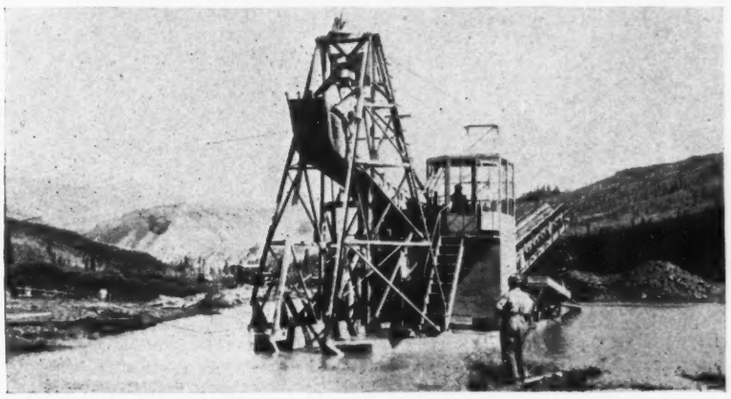
▶President Quezon has signed a proclamation withdrawing four gold-bearing properties from public lands. One of these is that owned by Demonstration Gold Mines, Ltd., inside the city limits of the city of Baguio. A controversy between the Government and the company over this property has been going on for several years. The decision will probably mean that other properties in the same area (in the Baguio district from which the bulk of Philippine gold has come for years) will be explored, with the possibility of new deposits being discovered. Other properties affected are claims owned by the I.X.L. Mining Company in Masbate; by the Compañia de Filipinas at Darab, Palawan; and by Clemente Largo in Cebu.

▶A natural effect of the war on the Philippines has been a rise in freight rates; since the European war started there have been three increases in shipping charges, totaling 50 per cent. This has naturally affected the cost of vital mining supplies and equipment. In anticipation of this situation, practically all of the mining companies laid in heavy stocks in 1939—up to eighteen months' supplies. Prices did go up during 1939, as expected, but have fallen off during 1940, partly because of overstocking by Chinese dealers. As a result, most of the companies have gone back to their usual policy of maintaining from three to six months' supplies in their warehouses, thus avoiding tying up funds earmarked for dividends. Prices in general have gone up directly as have the freight rates; most of the companies have contracts for the important materials. Dynamite is practically unchanged; two to four-year contracts were arranged some time ago, and favorable freight rates secured. Fuel oil is up 30 per cent, as is drill steel. Steel balls are 15 per cent higher; cyanide is changed only by freight rates. Coke (which is used by two smelters) is 50 per cent higher than before the war. As far as the mining personnel is concerned, the cost of living has taken about a 25 per cent jump.

▶A natural question which those interested in Philippine mining ask is, "Will supplies and equipment be cut off in case of a war in which the United States is involved, either in the Pacific or the Atlantic?" There are so many qualifications to an answer to such a question that it would be foolhardy to make predictions. The facts, however, are these: Most of the supplies and machinery come from the United States, and as long as communications are open between Manila and the Pacific Coast there will be no lack of supplies. Some of the fuel oil comes from Borneo. This might be shut off. In case of a sudden emergency the United States armed forces might draw on the fuel-oil reserves which have been established by the various companies. In general, however, the industry looks forward to uninterrupted operation, although interruption of deliveries from time to time may be expected.

EQUIPMENT NEWS

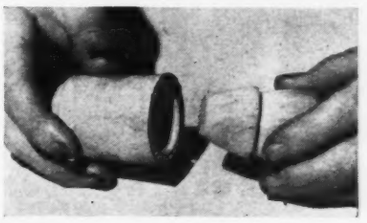
Single-Bucket Gold Dredge for Shallow Placers



YUBA Manufacturing Company, 351 California St., San Francisco, Calif., announces the exclusive manufacturing and sales rights to the Becker-Hopkins single-bucket dredge designed to work small, shallow placer deposits. Contrary to the dragline dredges now used in the field consisting of an independent digging element and a floating washing plant, the new dredge is a single, self-contained unit operating on the principle much like that of the conventional bucket-line dredge. Specifically, each succeeding cut of the digging bucket follows the preceding cut, thus assuring a constant flow of gravel to the revolving screen and thorough clean-up of the bedrock. The patented digging bucket is attached to a U-shaped flume, both units making up the digging boom. The boom-flume is telescoping. Material dug by the bucket is conveyed through the flume to the revolving screen, with a jet of high-pressure water aiding and hastening the transfer when the boom has been raised to the maximum point of elevation. The digging boom is actuated by compressed air. Two of the units described, equipped with 1-cu.yd. buckets and digging from 15 to 17 ft. below water, have been operating in Alaska for the last two seasons, and operating costs are said to approximate those of conventional bucket-line dredges, and considerably lower than those obtained by dragline dredges. Being of sectionalized construction, including a pontoon-type hull, the new dredge can be speedily transported at low cost to a new field after exhaustion of the old.

Blasting Plugs

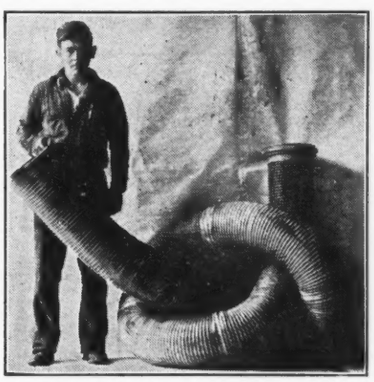
DESIGNED as a substitute for tamping or stemming and claiming to increase the effectiveness of the explosive charge, the Heitzman Company, Lawson Bldg., Glendale, Calif., offers a blasting plug consisting of a soft thimble-shaped rubber cup and a conical wooden wedge. The wedge is rammed into the open end



of the cup to expand it and insure a snug fit against the wall of a drill hole. Plug sizes are from $1\frac{1}{4}$ to $2\frac{3}{4}$ in. in diameter. Larger sizes up to 6 in. are made on special order. After placing the powder in the drill hole, the plug $\frac{1}{8}$ in. smaller in diameter than the hole is pushed down directly above the charge and followed with the wooden wedge. The wedge then is tapped with a tamping stick to expand the rubber cup and seal the hole. Advantages claimed by the manufacturer are: a saving of 75 per cent of time ordinarily required for tamping; an increase in efficiency, and reduction of accidents from misfires.

Ventilation Duct and Tubing

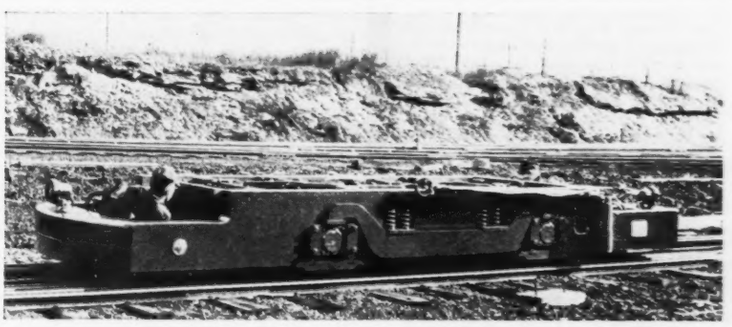
HERSEY & COMPANY, 2021 Minor North, Seattle, Wash. announces two new products applicable for ventilation purposes. For exhausting air, light dusts, and gas, a tubing illustrated herewith, known as "Flexaust," is



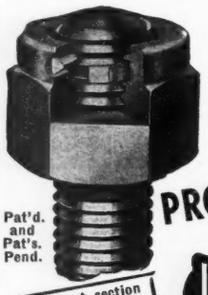
offered. This is a wire reinforced rubberized fabric with inner and outer rubber coatings holding the wire in place. An airtight coupling closed by a single wing-bolt is available where quick detachment is desired; otherwise the duct may be slipped over the end of metal pipe or fan inlet. This tubing is available from 4 in. to 24 in. in diameter.

A new light-weight flexible tubing for blowing, made of rubberized fabric known as "Bloflex," is offered for mine ventilation. It is said to be easily handled and suspended and can be quickly coupled. A positive demountable wing-bolt coupling closes over the two rings, squeezing them together. Movable grips on the seam are said to make suspension wire unnecessary, as the tubing can be stretched and supported wherever there is a stoll plug, or convenient point on the pipe line. Short sections of this type tubing are said to make a "non-wrinkling" elbow of any angle for flexible canvas tubing of all types, being coupled by bailing wire.

To prevent the freezing of loose materials to the side of railroad cars, the Dow Chemical Company, Midland, Mich., uses a spray Dowflake calcium chloride solution



Offering a design in electric mine locomotives with an over-all height of only 26 in. is announced by the General Electric Company, Schenectady, N. Y. The locomotive shown above is of 15-ton capacity, employing high-speed, body-mounted, self-ventilated motors and double-reduction gear drives



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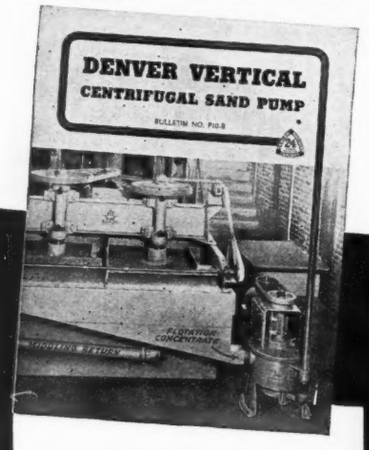

This NEW BULLETIN No. P10-B on the Denver Vertical Centrifugal Sand Pump will help you solve the handling of troublesome pulps without dilution or operating attention. This pump will handle all material which can be made to flow by gravity to the feed opening—sticky flotation froth, gravity concentrates, deslimed pulps, unit flotation cell concentrates, amalgam barrel tailings, jig hutch products, etc.

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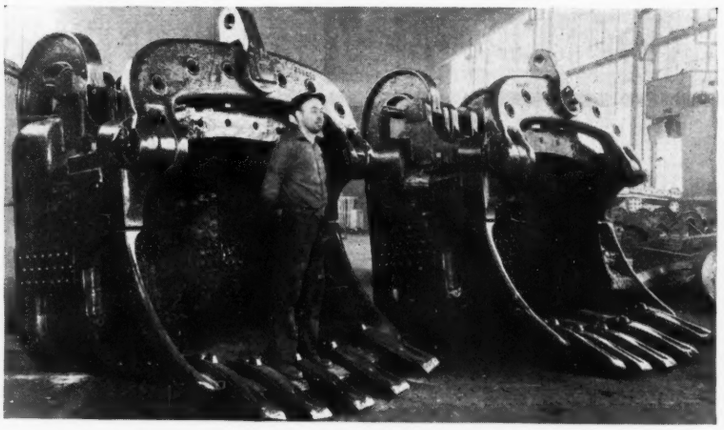
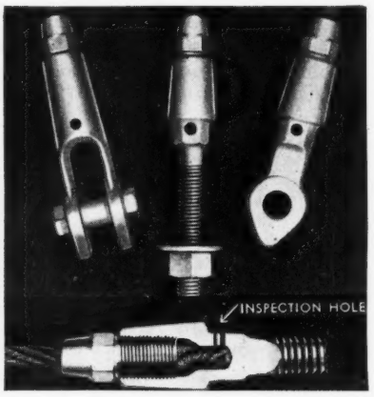


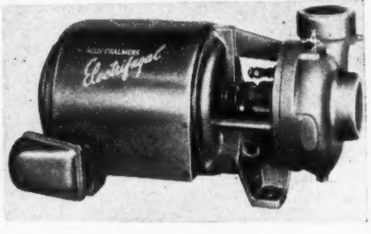
To resist heavy pressure and meet the requirements of higher-speed shovel operations in Western open-pit copper mines, the American Manganese Steel Division, Chicago Heights, Ill., announces increased use of its all-manganese steel dippers of the renewable-lip type, to which are attached the manufacturer's Whisler C-clamp teeth. The buckets shown are of 4½-cu-yd. capacity



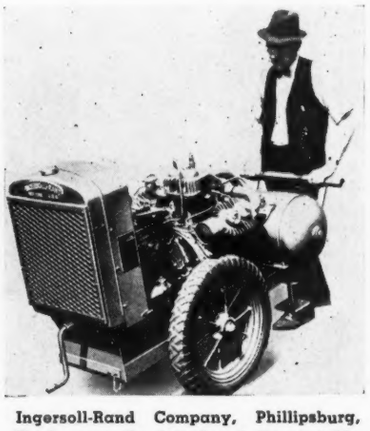
Three simple units make up the improved connector that grips cable with graduated compression. Made by the Electroline Company 4204 South La Salle St., Chicago they consist of a sleeve which slips over the end of the wire rope, a tapered plug which is inserted to separate and hold the strands of wire in the sleeve, and a covering socket which securely locks the cable

New Centrifugal Pump

ALLIS-CHALMERS Mfg. Company, Milwaukee, Wis., announces its new "Electrifugal" pump, which is an all-in-one centrifugal pump especially designed as a complete pump and motor unit on one shaft and one housing. Instead of using standard motors having special end housings and shaft extensions, the "Electrifugal" pumping unit has a special motor with a one-piece cast-iron motor yoke and pump bracket. The feet are cast integral with the housing and bracket and extend under the entire unit instead of under the motor only. In splash proof construction this pump is available in sizes from 1 hp. to 10 hp., inclusive at 3,500 r.p.m. and from ¾ hp. to 7½ hp. inclusive at 1,750 r.p.m. for heads up to 160 ft. Larger sizes of this type are in the process of design.



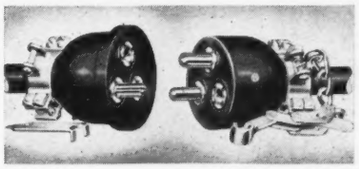
A one-hour breathing apparatus featuring carriage on the back is announced by Mine Safety Appliances Company, Pittsburgh, Pa. The complete weight of the unit is 124 lb.



Ingersoll-Rand Company, Phillipsburg, N. J., recently introduced its portable lightweight two-stage air-cooled compressor that delivers 60 cu.ft. of free air per minute at a discharge pressure of 100 lb.

Rubber Cable Conductor

OHIO BRASS COMPANY, Mansfield, Ohio, announces the development of a three-conductor plug-type rubber cable connector, known as the O-B Mechano-Plug, especially designed for connecting devices. It will accommodate No. 2 and smaller sizes of two- or three-conductor insulated cable. The entire unit is

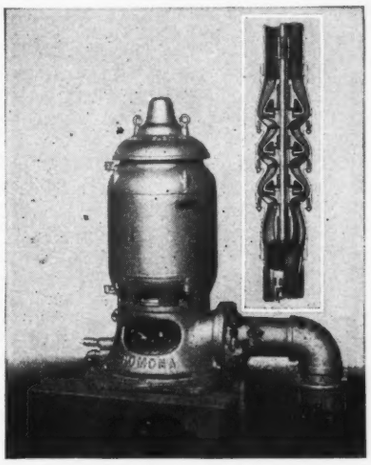


rubber-covered, with overlapping joints for the exclusion of dust and moisture.

The outstanding feature of the device is said to be its installation ease in the field. The copper strand is quickly inserted into plugs and receptacles and locked into permanent position by means of steel setscrews. Phosphor-bronze plugs in the male half of the connector, split to give a spring-tight fit, are arranged so that they can be inserted in the female body only in the proper position, thus safeguarding connection procedure. A chain lock arrangement makes it impossible to disconnect the device inadvertently.

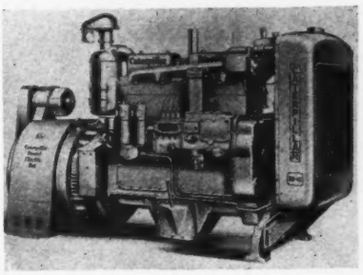
Redesigned Pumps

POMONA PUMP COMPANY, 547 East Commercial St., Pomona, Calif., announces the complete redesign of its line of 6-in. medium-capacity vertical turbine pumps. For a designed capacity of 100 g.p.m. against 110-ft. lift in a well and 50-lb. pressure above, a 7½-hp. motor is required, as against a 10-hp. motor with the old model. The efficiency



of this particular size of pump for this head capacity is said to have been increased 6½ points, and the number of stages has been reduced one-fourth. The initial cost of the entire unit has been lowered 20 per cent. Other advantages reported by the manufacturer are that the pumps are water-lubricated, with no stuffing box below ground level; that the specially designed semi-open impeller can be adjusted from the surface for wear and for changing capacity; and that they are non-sandlocking and non-gaslocking.

Chicago Pneumatic Tool Company, 6 East 44th St., New York, N. Y., announces a new size added to its line of diesel-driven portable compressors. The new unit shown above is a 500-cu.ft. Class P0-8 portable compressor with maximum discharge pressure 125 lb. Length of the unit is 15 ft. 4 in.



Two new models of diesel electric sets is announced by Caterpillar Tractor Company, Peoria, Ill., the 88-41 and the 77-34. The former develops 41 kw. at 900 r.p.m. when equipped with radiator fan The latter develops 34 kw. without fan. Both ratings are for the polyphase 60-cycle set. The sets are self-controlled, requiring only a circuit breaker

Combining the speed of a truck and the power of a tractor with a capacity for the average job, R. G. Le Tourneau, Inc., Peoria, Ill., announces its smallest Tournapull, the Model C for long-haul dirt moving

BULLETINS

Thermocouples. Leeds & Northrup Co., 4907 Stenton Ave., Philadelphia, Pa. Catalog N-33A(6) describes and illustrates assemblies, parts and accessories and contains information of general usefulness on the correct choice of couples. Pp. 40.

Pump Packing. Greene, Tweed & Co., 101 Park Ave., New York, N. Y. Booklet 7-40 contains descriptive information on mechanical pump and sheet packing; also a service chart for packings. Pp. 12.

Respirators. H. S. Cover, South Bend, Indiana. Booklet describes the manufacturer's line of respirator and gas-tight goggles. Pp. 11.

Electric Vibrators. Syntron Company, Homer City, Pa. Form 28 describes and illustrates the manufacturer's line of electric vibrators for application to hoppers, chutes, and railway cars. Pp. 8.

Rooter. R. G. Le Tourneau, Inc., Peoria, Ill. Form R-311-5-40 describes and illustrates application of the company's rooter for ripping up tough materials and frozen ground. Pp. 6.

Air Conditioning. Carrier Corp., Syracuse, N. Y. AC-127 is a simplified presentation of air-conditioning data for solution of psychrometric problems. Pp. 6.

Automatic Control for Synchronous Motors. Electric Machinery Mfg. Co., Minneapolis, Minn. Bulletin 159 describes

THE ROSS FEEDER

Completely Controls

the flow of any size material from Storage Bins, Hoppers or Open-Dump Chutes to Crushers, Conveyors, Screens, etc.

High in efficiency. Low in maintenance and power consumption.

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REPLACES HEAVY PIPE for pressure lines at a big saving in original cost, shipping, handling and installation. Only Naylor has the Lockseam Spiralweld structure that makes this pipe stronger, leak-tight, more flexible, safer than any other light-weight pipe. Sizes from 4" to 30" in diameter. All type fittings and connections.

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Locomotives

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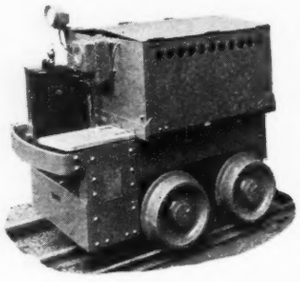
A 2½ ton storage battery locomotive, specially designed to answer intermediate mine haulage needs. Spur gear drive is totally enclosed —bearings are anti-friction, *sealed* to keep out muck and water— powerful brake shoes are mounted so as to be protected from wheel wash.



TYPE J

Combining low original cost and a minimum of upkeep with high operating efficiency, this unit meets all metal mining conditions. Check its ability to help you lower your haulage costs. A letter requesting further data on either the Type J or the Type K will receive immediate attention. Write today.

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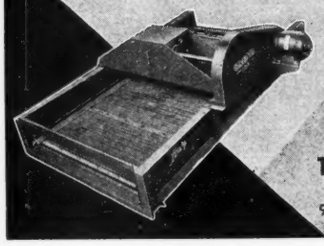
THE Leahy HEAVY DUTY

No-Blind VIBRATING SCREEN with TRI-VIBE —for Fine Mesh Screening



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90% to 97% Efficiency Rating. Only ½ H. P. Required for Maximum Load.

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THE DEISTER CONCENTRATOR COMPANY

The Original Deister Co., Est. 1906

915 GLASGOW AVE. FORT WAYNE, IND.

polarized field frequency automatic control for synchronous motors. Pp. 8.

Transmission Line Materials. Ohio Brass Co., Mansfield, Ohio. The company has a 2-page templet sheet available for use in preparing drawings of transmission line materials.

Deep-Well Pumps. Byron Jackson Co., Los Angeles, Calif. Bulletin 38505 is a detail colored design of the manufacturer's deep-well submersible pump. Pp. 8.

Wire-Rope Connectors. Electroline Co., 4121 South La Salle St., Chicago, Ill. Bulletin F-2 describes the company's Fiege wire-rope connectors with built-in vibration-damping design. Pp. 8.

Pre-Fabricated Piping. American Locomotive Co., 30 Church St., New York, N. Y. Bulletin 1022 describes advantages and facilities in using prefabricated piping in various industries. Pp. 4.

Industrial Gas Masks. Mine Safety Appliances Co., Pittsburgh, Pa. Bulletin ED-7 describes and illustrates the company's industrial gas masks, and includes a list of gases against which protection is offered. Pp. 6.

Automatic Coupler. National Malleable & Steel Castings Co., Cleveland, Ohio. Circular 5240 describes and illustrates the manufacturer's improved Willison automatic coupler for mine-car use. Pp. 15.

Diesel Engines. Worthington Pump & Machinery Corp., Harrison, N. J. Bulletin S500-B38 describes and illustrates features of the manufacturer's Type DD four-cycle direct-injection totally enclosed diesel engine from 250 to 665 hp. Pp. 8.

Blowers. Allis-Chalmers Mfg. Co., Milwaukee, Wis. Bulletin B-6048 describes and illustrates various single-stage motor and mechanically driven blowers for industrial uses. Blower accessories are also described. Pp. 23.

Tex-Rope Drives. Bulletin B-6051-A describes and illustrates uses of Tex-rope drives. Dimensions, horsepowers, and speed range tables are shown. Pp. 16.

Conveyor Belt Data Sheet. B. F. Goodrich Co., Akron, Ohio. A form developed by C. W. Staacke, of the company, for use in compiling data on conveyor belts is made available by the manufacturer.

Packing. Wayne Davies Packings, Inc., 325 West Huron St., Chicago, Ill. Form 21 describes features of the manufacturer's double "U" packings for high pressures. Pp. 4.

Jackleg. Ingersoll-Rand Co., 11 Broadway, New York, N. Y. Form 2690 describes and illustrates features of the company's new Jackleg, an air-feed mounting designed for use with Jackhamers. Pp. 4.

Pressure Reducing Control. Bailey Meter Co., 1050 Ivanhoe Road, Cleveland, Ohio, explains and illustrates pressure reducing and desuperheating control units of the air-operated type. Pp. 15.

Indicators. Bacharach Industrial Instrument Co., 7000 Bennett St., Pittsburgh, Pa. Bulletin 337 describes and illustrates the company's CO_2 indicator. Pp. 4. Bulletin 279 describes features of Type 2CP indicator for use on medium and moderately high speed engines. Pp. 4. Bulletin 280 describes Premax adaptors for diesel engines. Pp. 4. Bulletin 281 describes the manufacturer's Type 4HS high-speed engine indicators. Pp. 4.

Mining Equipment. Hassell Engineering Co., Colorado Springs, Colo. Catalog G-4000 describes and illustrates the company's line of used mining equipment. Pp. 12.

Water Softeners. The Permutit Co., 330 West 42d St., New York, N. Y. Bulletin 2341 describes and illustrates the company's hot-process water softeners. Pp. 29.

Scale and Rust Removal. Oakite Products, Inc., 57 Thames St., New York, N. Y. Form 4305-R1 describes the manufacturer's compound No. 32 for use in de-scaling various types of water-cooled equipment. Pp. 20.

Circuit Breakers. Heinemann Circuit Breaker Co., Trenton, N. J. Catalog 40 describes and illustrates the manufacturer's line of magnetic circuit breakers of the time-delay and instantaneous types. Pp. 35.

Pulverizers. Raymond Pulverizer Division, Combustion Engineering Co., 1324 North Branch St., Chicago, Ill. Bulletin 47 describes the company's Imp pulverizer. Pp. 4.

Jigs. Denver Equipment Co., Denver, Colo. Bulletin J2-B describes and illustrates features of the manufacturer's Denver mineral jig. Pp. 15.

Mill Equipment. Hardinge Co., York, Pa. Bulletin 100 describes and illustrates the manufacturer's line of mill equipment, dryers, and the electric ear that regulates feed rate of grinding mills. Pp. 4.

INDUSTRIAL NOTES

Sterling Pump Corporation, Hamilton, Ohio, recently acquired the Turbine Pump Division of the Roots-Connersville Blower Corporation, of Connersville, Ind. Henry J. McKenzie was recently appointed president of the Sterling Pump Corporation.

H. N. How, president of the Western Machinery Company, announces that **Roy Thrailkill** recently joined the staff of the company's Los Angeles Branch.

W. C. Weslow's appointment as manager of the mining division of Carboloy Company, Inc., Detroit, Mich., has been announced by W. G. Robbins, president of the company.

C. T. Hill was recently elected president of the Pyrites Company, Wilmington, Del., to fill the vacancy caused by the death of J. H. Saville.

The John A. Roebling's Sons Company, Trenton, N. J., announces the appointment of **Roger H. Clapp,** formerly Philadelphia branch manager, as assistant general manager of sales, with headquarters in Trenton. **Earl N. Graf,** former manager of the Pittsburgh branch of the company, has been appointed assistant manager of sales, wire rope division, with headquarters at Trenton.

Allen-Sherman-Hoff Company, of Philadelphia, Pa., recently opened a branch office in New York City at 271 Madison Ave., Room 1006. B. C. Berry and P. D. Oesterle are in charge.